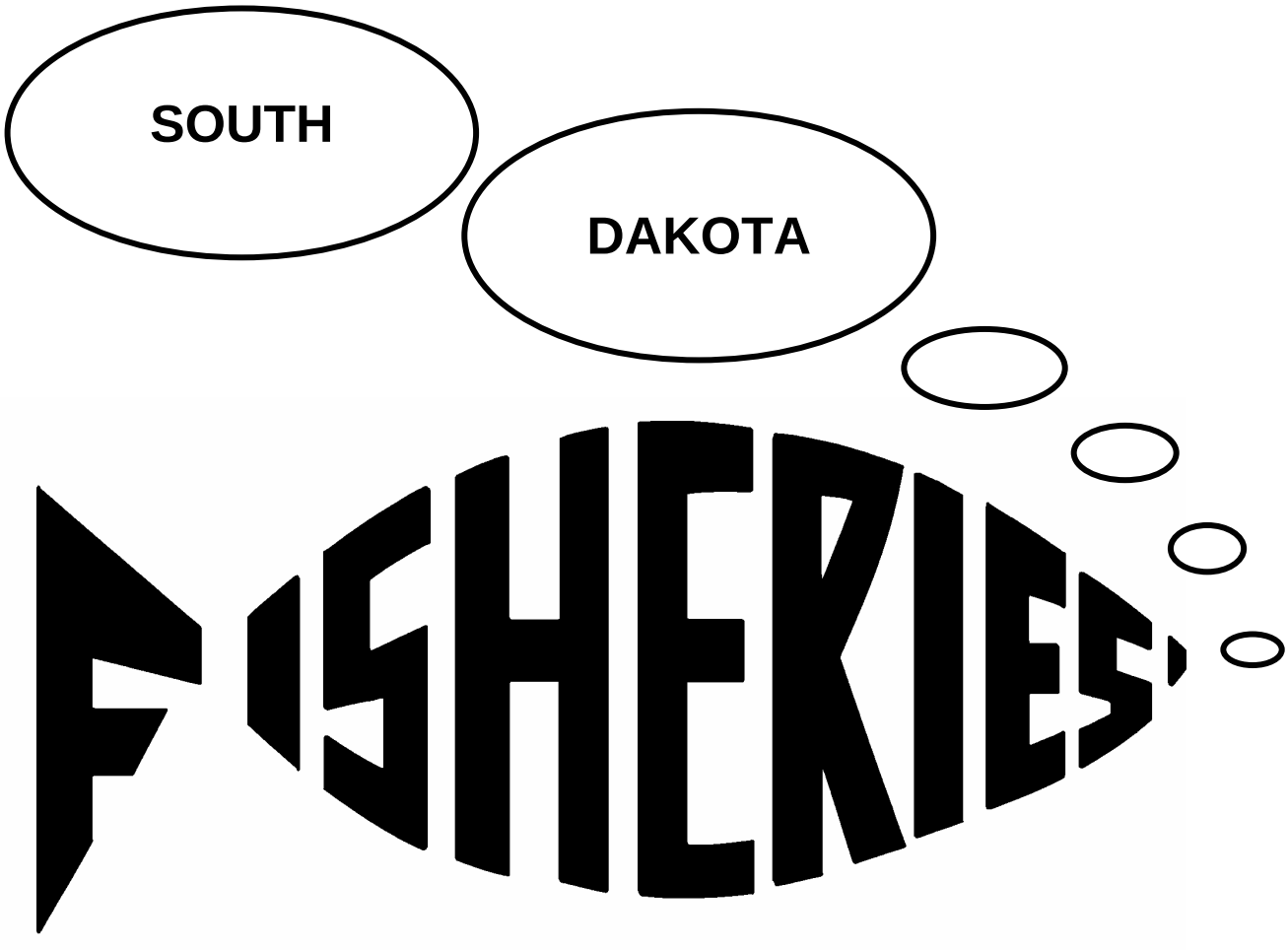

ANNUAL FISH POPULATION AND ANGLER USE, HARVEST, AND PREFERENCE SURVEYS ON LAKE SHARPE, SOUTH DAKOTA, 2008

South Dakota
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Game, Fish and Parks
Wildlife Division
Joe Foss Building
Pierre, South Dakota 57501-3182

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ANNUAL FISH POPULATION AND ANGLER USE, HARVEST AND PREFERENCE SURVEYS ON LAKE SHARPE, SOUTH DAKOTA, 2008

By

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PREFACE

Information collected during 2008 is summarized in this report. Copies of this report and references to the data can be made with permission from the authors or the Director of the Division of Wildlife, South Dakota Department of Game, Fish and Parks, 523 E. Capitol, Pierre, SD 57501.

The authors would like to thank the following individuals from the South Dakota Department of Game, Fish and Parks who helped with data collection, data entry, manuscript preparation, and report editing: Brian Beel, Jerry Big Eagle, Tane Bramblee, Kayla Gabriel, Torey Garrett, Doug Jones, Darla Kusser, Aaron Leingang, Nathan Pool, Jim Riis, Kip Rounds, Aaron Rumpca, John Simpson, Caitlin Wagner, and Trent Withers.

The collection and analysis of data for these surveys was funded, in part, by Federal Aid in Sport Fish Restoration, (D-J) project F-21-R-41, Statewide Fish Management Surveys. Some of these data have been presented previously in segments F-21-23 through 40.

EXECUTIVE SUMMARY

This report includes annual fish population data and angler use, harvest, and preference data collected in 2008, for Lake Sharpe, South Dakota. Fish population data and angler use and harvest survey data from previous years are referenced in this report. Results of these surveys are used to evaluate progress towards strategic plan objectives as outlined in the Missouri River Fisheries Program Strategic Plan.

Mean walleye gillnet CPUE in 2008, at 19 walleye/net-night, was similar to the 2007 value of 22 fish/net-night. Walleye ranging from 142 to 614 mm were collected during the August 2008 gill net survey. Approximately 21% of walleye in the 2008 gill net sample were ≥ 380-mm (15-inch minimum length), 4% were ≥ 460-mm (18 inches), and 1% were ≥ 508-mm (20 inches). These percentages though lower than 2007, can be attributed to the increasing number of sub-stock length walleye in the Lake Sharpe population. Approximately 65% of the walleye sampled during the August gill net survey in 2008 were below stock length.

The 2008 mean age-0 electrofishing CPUE, of 96 fish/h was the highest recorded since the survey began in 1995. Walleye relative weight (*Wr*) for 2008, at 85, was similar to most years for Lake Sharpe. Age-3 (2005) walleye comprised the largest portion of the walleye catch in gill nets in 2008, followed by the 2006 year class.

Seventeen species of age-0 or small prey fishes were collected by shoreline seining in 2008. All species had been previously sampled in Lake Sharpe. Gizzard shad comprised the majority of the catch in 2008, with a mean CPUE of 1,620 fish/haul.

Regulations in 2008 for smallmouth bass in Lake Sharpe included a 355-to-457-mm (14- to 18-inch) protected slot with anglers allowed to harvest one bass ≥ 457-mm as part of the five-fish daily limit. Previous regulations included a protected slot from 304-to-457-mm (12-to18-inch) with anglers allowed to harvest one bass ≥ 457-mm as part of the five-fish daily limit. The change in protected slot length limits for 2008 was put into place to allow anglers to harvest more small (≤ 355-mm) smallmouth bass and increase the effectiveness of the regulation. Mean CPUE values of smallmouth bass collected by shoreline electrofishing were unchanged at 21 fish/h at Joe Creek (2007 and 2008) and were similar at 57 and 60 fish/h at Big Bend Dam in 2007 and 2008, respectively. Growth is unchanged since the regulation change with mean back-calculated length at age 4 still exceeding statewide and Missouri River reservoir averages.

An estimated 95,113 anglers days were spent on Lake Sharpe during the April-September 2008 daylight period, falling below the Lake Sharpe Strategic plan goal of 100,000 angler days. An estimated harvest of 92,545 walleye occurred during the 2008 period, which was below the Lake Sharpe Strategic plan goal of 100,000. Estimated angler catch of white bass declined from 108,494 fish in 2005 to 12,160 in 2008, a decline of 89%, due to a die-off during the summer of 2005. Approximately 92% of the smallmouth bass harvested during the April-September 2008 period were <355-mm in length and 3% were ≥457-mm in length. Approximately 6% of the smallmouth bass measured during angler interviews were within the protected slot length limit.

Estimated hourly harvest rate for all species combined, for the April-September 2008 daylight period, at 0.4 fish/angler-h, was higher than the strategic plan objective of 0.35 fish/angler-h. The walleye catch, harvest, and release rates for 2008 (0.95, 0.29, 0.66, respectively) were similar to the 2007 period (1.04, 0.34, 0.70, respectively). The smallmouth bass catch rate was 0.42 fish/angler-h during 2008. The white bass catch rates decreased from 0.40 fish/angler-h during 2005 to 0.06 fish/angler-h during 2008.

Approximately 83% of angling parties interviewed in 2008 indicated some degree of satisfaction with their fishing trip, a value greater than the Lake Sharpe Strategic Plan objective of 70%. For the April-September 2008 daylight period, Lake Sharpe anglers contributed approximately 7.5 million dollars to local economies, based on an estimated 95,113 trips at an estimated $79 per trip.

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ANNUAL FISH POPULATION AND ANGLER USE, HARVEST AND PREFERENCE SURVEYS ON LAKE SHARPE, SOUTH DAKOTA, 2008

INTRODUCTION

Anglers spent over 1.5 million hours fishing the Missouri River system in South Dakota in 2007 (Adams et al. 2008; Potter et al. 2008, Jason Sorensen, personal communication). Approximately 48% of South Dakota resident anglers fished the Missouri River system in 2003 and 35% of those anglers fished Lake Sharpe (Gigliotti 2004). Also, approximately 33% of angler days in South Dakota in 2003 were spent on the Missouri River system (Gigliotti 2004). The South Dakota Department of Game, Fish and Parks (SDGFP) recognizes the importance of the Missouri River fisheries program and considers it a major program in strategic planning efforts (SDGFP 1994).

Lake Sharpe is a 128-km long mainstem Missouri River flow-through reservoir and has a surface area of 24,686 ha. Lake Sharpe has supported between 61,000 and 123,000 angler trips, during the April-September daylight period, in recent years. Walleye, and to a lesser extent, smallmouth bass, white bass, channel catfish, sauger, and rainbow trout, provide much of the sport fishing opportunity in this reservoir.

Lake Sharpe is an important fisheries resource in South Dakota and its habitat and fish community must be protected and maintained. The importance of Lake Sharpe to Missouri River fisheries is documented in the goals, objectives and strategies developed for management of this system (SDGFP 1994). Conducting annual surveys documenting fish community and population parameters, in association with collecting data on angler use, harvest, attitudes, preferences, and level of satisfaction, are primary strategies outlined in that plan. This information is required to evaluate objectives and strategies and to identify future management strategies. Trends and status of fish populations discussed in this report provide valuable information for evaluation of walleye regulations implemented in 1990 and modified in 1999, 2004 and 2006. This report includes data collected for Lake Sharpe in 2008 and comparisons to data from previous years.

MANAGEMENT OBJECTIVES

Reservoir-wide Objectives

- Provide a minimum of 100,000 angler days of recreation with a harvest rate of 0.35 fish per angler hour, and a 70% angler trip satisfaction rating.

- Continually work to preserve or enhance and protect the existing fish community structure, diversity and aquatic habitats of Lake Sharpe

Species-Specific Objectives

- Provide a walleye fishery that can annually support a minimum of 75,000 angler days of recreation with a harvest of 100,000 walleye and a harvest rate of 0.3 walleye per angler hour.

- Provide a white bass fishery that can annually support a minimum of 5,000 angler days of recreation with a harvest of 30,000 white bass and a harvest rate of 0.3 white bass per angler hour.

- Provide a rainbow trout fishery that can annually sustain a minimum of 5,000 user-days of angling, a catch rate of 0.2 fish per hour for anglers specifically fishing for rainbow trout, and an annual harvest of 2,500.

- Provide a smallmouth bass fishery that can sustain a minimum of 5,000 days of smallmouth bass angling opportunity, a harvest of 10,000, and a catch rate of 0.3 fish per angling hour for anglers specifically fishing for smallmouth bass.

- Provide a channel catfish fishery that can sustain a minimum of 10,000 days of recreation, and an annual harvest of 15,000, and a catch rate of 0.33 fish per angling hour for anglers specifically fishing for channel catfish.

- Maintain Lake Sharpe population abundance of gizzard shad, emerald and spottail shiners at or above the five-year average, as indexed by shoreline seining.

SAMPLING STRATEGIES

The sampling strategies used to determine SDGFP's ability to achieve stated fisheries management objectives, as outlined in the strategic plan, are accomplished through fish population and angler surveys which provide the following information:

Annual fish population surveys (Federal Aid Code 2102):

- species composition
- relative abundance
- population age structure
- growth
- condition
- recruitment
- survival and mortality rates
- population size structure
- effects of regulations
- effects of sport fish harvest

Angler use, harvest, and preference surveys (Federal Aid Code 2109):

- recreational angling pressure
- fish harvest, release and catch rates, by species
- angler party size, day length, and state of residency
- annual local economic impact of the sport fishery
- effects of regulations and other management activities
- size structure of fish in the harvest
- angler preference, attitude and satisfaction information

STUDY AREA

Lake Sharpe is located in central South Dakota (Figure 1) and extends from Oahe Dam to Big Bend Dam. The reservoir has been divided into three zones for survey purposes. The upper zone extends from Oahe Dam to the downstream end of LaFramboise Island, the middle zone extends from the downstream end of LaFramboise Island to DeGrey, and the lower zone extends from DeGrey to Big Bend Dam. Standard gill netting, seining and electrofishing locations have historically been Farm Island, DeGrey/Fort George, Joe Creek and North Shore. Electrofishing is also conducted at LaFramboise Island and the Oahe Dam stilling basin. Historical, biological, chemical and physical parameters have been discussed previously (Benson 1968; Riis 1986; Schmidt 1975). Selected physical characteristics, management classification, and fish population survey schedules for Lake Sharpe are presented in Table 1.

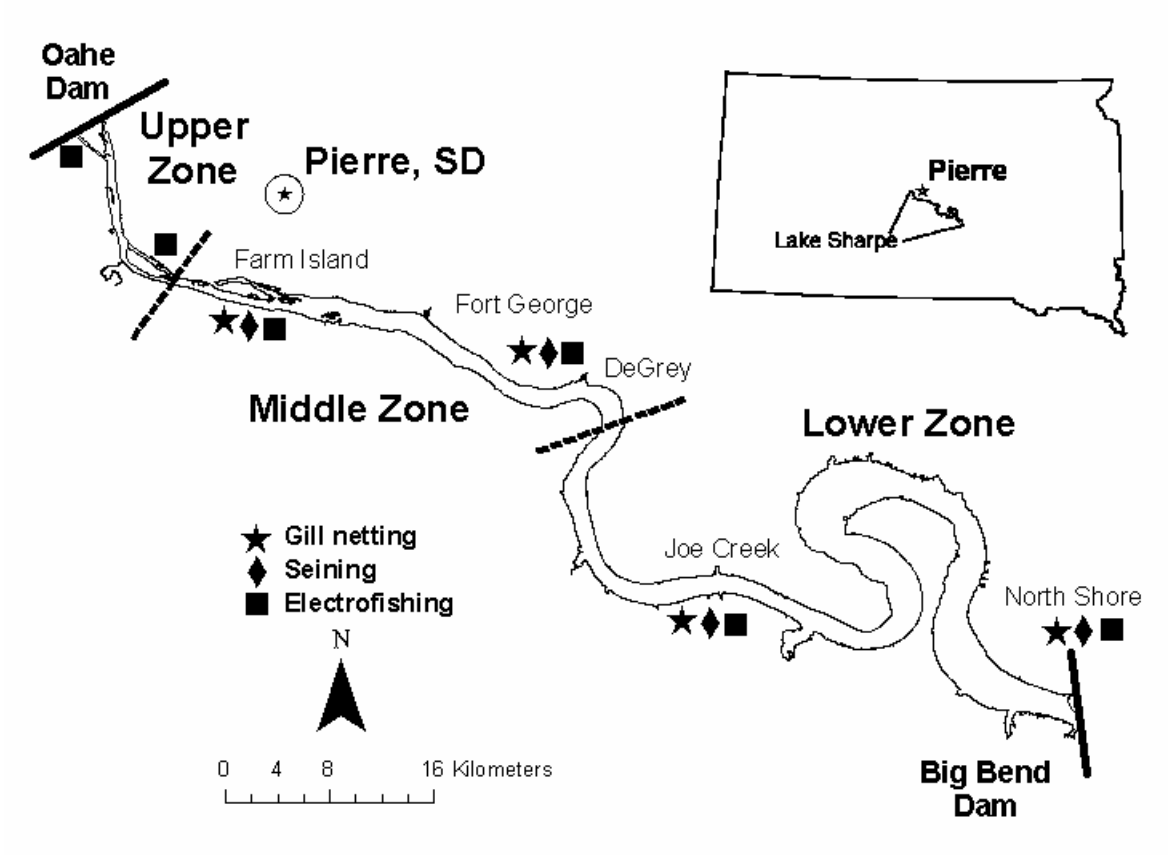

Figure 1. Lake Sharpe, South Dakota, gill netting, seining, and electrofishing locations.

Table 1. Physical characteristics at normal pool elevation, management classification, and sampling times and depths, for annual fish population surveys on Lake Sharpe, South Dakota.

Characteristic:	Description
Location:	From Oahe Dam to Big Bend Dam
Surface area (X 1000 ha):	25
Depth (m)-maximum: **-mean:**	23.5 9.5
Bottom substrate:	Sand, gravel, shale and silt
Water source:	Missouri River and tributaries
Management classification:	Cool and warm water permanent
Gill net depths: (m)	0 - 9.1 9.1 - 18.3
Number of gill nets:	24
Gill netting survey date:	August
Number of seine hauls:	16
Seining survey date:	August
Nighttime electrofishing survey dates:	May-June, September-October

REGULATION HISTORY

Fish population and angler use and harvest survey data is essential when evaluating special management regulations. Walleye harvest regulations for Lake Sharpe have differed from standard statewide regulations since 1990, when an April through June 14-inch (356 mm) minimum length limit was placed in effect on Lakes Oahe, Sharpe, and Francis Case (Table 2). Beginning in 1999, the minimum length was increased to 15 inches (381 mm) and was in effect during all months except July and August. A stipulation that at most one fish in the daily limit could be 18 inches (457 mm) or longer was also added to the walleye regulation package in 1999. Changes implemented for 1999 were made to reduce harvest during a period of high angler use and increase the abundance of walleye longer than 18 inches in the population to increase the quality of the fishery. The daily walleye limit was reduced to three fish for 2004 and 2005 to reduce harvest during a period of low walleye abundance. In 2006, the daily limit was returned to the statewide daily limit of four and the one walleye over 18 inches stipulation was increased to 20 inches (508 mm).

Experimental regulations for smallmouth bass were implemented in 2003 and were evaluated through 2007 for their effectiveness at increasing the size structure of the smallmouth bass population in Lake Sharpe (Table 2). Special regulations for smallmouth bass from 2003 through 2007 included a 12-to-18-inch (306-457-mm) protected slot length limit with at most one fish 18 inches or longer in the daily limit. In 2008, smallmouth bass regulations on Lake Sharpe were altered to include a 14-to-18-inch (355-457-mm) protected slot length limit with at most one fish 18 inches or longer in the daily limit. The regulation change was implemented to increase harvest of smaller smallmouth bass. This regulation will be monitored in the future to determine its effectiveness.

Table 2. History of special harvest regulations for walleye and smallmouth bass, on Lake Sharpe, South Dakota, 1968 through 2008.

Species	Period	Daily limit	Possession limit	Length restrictions
Walleye/ sauger in combination	1968-1983	8	16	None
	1984-1989	6	12	None
	1990-1998	4	8	• April-June 14 inch minimum length
	1999-2003	4	8	• Sept.-June 15 inch minimum length • At most one equal to or longer than 18 inches
	2004-2005	3	8	• Sept.-June 15 inch minimum length • At most one equal to or longer than 18 inches
	2006-2008	4	8	• Sept.-June 15 inch minimum length • At most one equal to or longer than 20 inches
Smallmouth bass	2003-2007	5	10	• Only fish shorter than 12 inches or 18 inches and longer may be kept and at most one fish in the daily limit may be 18 inches or longer.
	2008	5	10	• Only fish shorter than 14 inches or 18 inches and longer may be kept and at most one fish in the daily limit may be 18 inches or longer.

SAMPLING METHODS

FISH POPULATION SURVEYS

Data Collection

Variable-mesh gill nets, seines and boat electrofishing were used to sample fish populations in Lake Sharpe during 2008 (Figure 1). Three multifilament, variable-mesh (containing meshes with the following bar mesh dimensions: ½, ¾, 1, 1 ¼, 1 ½, and 2 inches; 12.7, 19.1, 25.4, 31.8, 38.1, and 50.8 mm bar mesh) gill nets (Lott et al. 1994) that were 91.4 m (300 ft) in length were fished overnight (approximately 20 h), on the bottom, in each depth zone (0-9.1 m and >9.1 m), where possible, for a total of six nets per location with four sampling locations on Lake Sharpe (Figure 1). All fish collected were identified and counted. All walleye and sauger captured were measured for total length (TL; mm) and weighed (g). At each sampling location, the first 50 individuals of each species, excluding walleye and sauger, were measured and weighed. Otoliths (10 per cm length group per sampling location) were collected from walleye and sauger captured during the standard gill net survey. Otoliths from walleye and sauger less than 350 mm were

aged whole while submersed in water in a black dish. Otoliths from walleye and sauger greater than 350 were aged with otoliths cracked in half and charred prior to aging, similar to techniques described by Isermann, et al. (2003).

Nylon seines, previously described by Lott et al. (1994), were used to collect age-0 fish and small littoral species. A quarter-arc seine haul was accomplished by methods described in Martin et al. (1981). Four seine hauls were made at each of the four sampling locations (Figure 1). All fish collected with seines were placed on ice and identified and counted in the lab.

Spring (May and early June), nighttime electrofishing was used to gather data on smallmouth bass population parameters. Smallmouth bass captured were measured (TL; mm), weighed (g) and scales were taken from 10 smallmouth bass per centimeter length group, at each sampling location at Big Bend Dam face and natural rock shorelines near Joe Creek. Six, 15-minute electrofishing runs were conducted at night, during late May and early June, along the shoreline, at each sampling location. A 5.3-m Smith-Root SR-18 electrofishing boat, with a 5.0 GPP electrofisher, was used to conduct the survey. The electrofishing unit was set for pulsed D.C. current and a 30 pulse/s frequency. Voltage and amperage ranged between 270-300 V and 7-10 A, respectively. Each standard sampling site was sampled on three different occasions (overall, eighteen runs per site) during the one-month survey period, to reduce possible biases in size structure and catch rate associated with single sampling events (Lott 1996, 2000).

Fall (Sept./Oct.), nighttime electrofishing for age-0 walleye was included in standard fish population surveys beginning in 1995 to assess walleye reproduction. Beginning in 1998, a sampling location was included at DeGrey to provide uniformity between electrofishing, seining, and gill-netting survey sites. In 2000, electrofishing sites at LaFramboise Island and the Oahe Dam stilling basin were added to the list of standard electrofishing sites, for a total of six sampling locations (Figure 1). In 2003, DeGrey was replaced with Fort George, as a standard seining, electrofishing, and gillnetting station due to a lack of shoreline access at DeGrey, from siltation. The sampling design for fall electrofishing was identical to spring electrofishing. Otoliths were taken from a representative sample of walleye <240-mm in length to determine the maximum length for age-0 fish.

A list of common names, scientific names, and species abbreviations for fish mentioned in this report is presented in Appendix 1.

Data Analysis

Relative abundance of fish species were expressed as mean catch per unit effort (CPUE) for standard gill net (No./net night), seine (No./haul) and electrofishing (No./h) catches. A standard net night for the gill-net survey was approximately 20 h. Age and growth analyses were conducted for walleye, sauger, and smallmouth bass. Smallmouth bass scales and walleye and sauger otoliths were aged according to standard techniques (DeVries and Frie 1996). Back-calculations for scale samples were made with the computer program WinFin Analysis (Francis 2000). A standard y-intercept value for growth analyses of 35 mm was used for smallmouth bass (Carlander 1982). Age distributions for gill-net catches of walleye and sauger were developed by assigning ages to all fish captured during the survey, based on length-at-age-at-time-of-capture information. Proportional stock density (PSD; Anderson 1980) and relative stock density (RSD; Gablehouse 1984) values were calculated for walleye, sauger, smallmouth bass, channel catfish, white bass, and yellow perch. Length categories used in PSD and RSD are listed in Appendix 2.

Relative weight values (*Wr;* Anderson 1980) were calculated using standard weight (W_s) equations developed for smallmouth bass (Kolander et al. 1993), walleye (Murphy et al. 1990), sauger (Guy et al. 1990), channel catfish (Brown et al. 1995), white bass (Brown and Murphy 1991) and yellow perch (Willis et al. 1991). Stock density indices (PSD, RSD-P and RSD-M) and mean *Wr* values for white bass and yellow perch are presented in Appendix 10.

ANGLER USE, SPORTFISH HARVEST, AND PREFERENCE SURVEYS

Data Collection

Prior to 2003, angler use and sport-fish harvest survey techniques were patterned after a study designed and conducted on Lake Sharpe, South Dakota, by Schmidt (1975). This survey consisted of two independent parts. First, aerial pressure counts were used to estimate fishing pressure. Second, angler interviews were used to obtain estimates of individual angler harvest and catch and release rates. Beginning in 2003, a bus route survey design (Jones and Robson 1991) has been used for the angler use and harvest survey to increase the statistical reliability of the pressure estimates generated. A bus route design is a modified access survey typically used for fisheries with numerous access sites spread over a broad geographical region (Robson and Jones 1989; Jones et al. 1990). For a more detailed description of the bus route theory and techniques see Robson and Jones (1989), Jones and Robson (1991), and Pollock et al. (1994). Sampling was conducted from April 1, 2008 through September 30, 2008 for the sunrise-to-sunset (daytime) period. Diagrams of bus routes used on Lake Sharpe during the April-September survey period appear from Appendix 3 to Appendix 8. Random numbers were used to select the following for the bus route designs: day selection (weekday or weekends/holiday), day beginning at sunrise or ending at sunset, route direction (travel or wait start), starting location, and route selection. Daily schedules were then created with Microsoft Excel and Word for each day or shift selected.

Standard angler interviews included gathering information on trip length, type of fishing, target species, zip code, number in party, numbers of fish of each species harvested and released and lengths of walleye and smallmouth bass harvested by anglers. Questions on angler satisfaction, preferences, and attitudes were also included in each angler interview during the 2008 reservoir-wide angler use and harvest survey. Two different versions (forms A and B) of the angler interview data sheet were created, with different sets of angler attitude or preference questions on each sheet. Clerks alternated between forms A and B during each scheduled survey day. Anglers were asked how satisfied they were with their fishing trip, considering all factors. Questions were asked pertaining to current smallmouth bass regulations on Lake Sharpe. Anglers were asked if they were in favor of current smallmouth bass regulations. Parties that caught smallmouth bass were asked how many additional smallmouth bass they would have harvested, for their party, if the regulation had not been in effect. Anglers were also asked a question dealing with fishing tournaments on the Missouri River system. A complete list of satisfaction, attitude and preference questions asked in conjunction with the 2008 angler use and harvest survey appears in Appendix 9.

Data Analysis

Pressure count and angler interview data were entered and analyzed using the Creel Application Software (CAS) package (Soupir and Brown 2002) and 80% confidence intervals were calculated for estimates of fishing pressure and harvest. Catch, harvest, and release numbers and rates were also calculated. Lengths of harvested walleye and smallmouth bass were determined, as was angler demographic information. Median values of satisfaction question responses were calculated for each month and for the entire April-September survey period.

RESULTS AND DISCUSSION

FISH POPULATION SURVEYS

Species Composition and Relative Abundance

Walleye and channel catfish comprised the majority of the gill net catch in 2008 representing 52% and 14% of the catch, respectively (Table 3). Other species commonly caught during the 2008 survey included yellow perch, common carp, sauger, white bass, gizzard shad, freshwater drum, and smallmouth bass. Catch per unit effort has historically been used as an index of population abundance or density (Hubert 1996). Walleye CPUE of 19 fish/net-night in 2008 was similar to the five year average (Table 4). Channel catfish CPUE of 5 fish/net-night in 2008 was lower than the five year average. Rainbow trout were sampled for the first time in the previous five years.

Table 3. Relative species composition, by percent of total catch, of fish species collected during the standard August gill net survey on Lake Sharpe, South Dakota, during 2004 through 2008. Trace (T) indicates values < 0.5%.

Species	Year				
	2004	2005	2006	2007	2008
Walleye	28	37	43	49	52
Channel catfish	33	36	17	13	14
Yellow perch	3	4	7	5	3
Common carp	4	4	8	5	7
Sauger	6	4	6	6	7
White bass	6	4	6	4	2
Gizzard shad	10	3	7	10	3
Freshwater drum	2	3	3	2	3
Smallmouth bass	T	3	3	3	1
*Others	8	2	3	3	6

*Others includes: bigmouth buffalo, black bullhead, black crappie, rainbow trout, river carpsucker, shorthead redhorse, shortnose gar, shovelnose sturgeon, and white crappie.

Table 4. Mean catch per unit effort (CPUE; No./net-night) and standard error values (SE) for fish species collected with standard experimental coolwater gill net sets in Lake Sharpe, South Dakota, 2004-2008.

Species	2004	2005	2006	2007	2008
Bigmouth buffalo		<1 (0.1)	0	0	<1 (0.1)
Black bullhead	<1 (0.1)	0	0	0	<1 (0.1)
Black crappie	0	0	<1 (0.1)	0	<1 (0.1)
Bluegill	0	0	<1 (0.1)	0	0
Channel catfish	15 (2.2)	18 (4)	7 (1.7)	6 (0.9)	5 (1)
Common carp	2 (0.4)	2 (0.4)	3 (0.9)	2 (2.8)	3 (1)
Freshwater drum	1 (0.7)	1 (0.4)	1 (0.3)	1 (0.4)	1 (0.3)
Gizzard shad	5 (3.5)	2 (0.8)	3 (1.2)	4 (2.9)	1 (1)
Goldeye	<1 (0.4)	<1 (0.1)	0	0	0
Northern pike	0	0	<1 (0.1)	0	0
Rainbow smelt	<1 (0.1)	0	0	0	0
Rainbow trout	0	0	0	0	<1 (0.04)
River carpsucker	<1 (0.2)	<1 (0.3)	<1 (0.1)	<1 (0.1)	<1 (0.1)
Sauger	3 (0.6)	2 (0.5)	2 (0.7)	3 (0.7)	3 (0.5)
Shorthead redhorse	1 (0.4)	<1 (0.1)	<1 (0.1)	<1 (0.1)	<1 (0.6)
Shortnose gar	<1 (0.1)	<1 (0.1)	<1 (0.2)	<1 (0.1)	<1 (0.1)
Shovelnose sturgeon	1 (0.6)	<1 (0.1)	<1 (0.1)	<1 (0.2)	1 (0.6)
Smallmouth bass	<1 (0.1)	1 (0.8)	1 (0.8)	1 (0.9)	<1 (0.1)
Smallmouth buffalo	<1 (0.1)	0	0	<1 (0.1)	0
Spottail shiner	0	<1 (0.1)	0	<1 (0.1)	0
Walleye	13 (2.2)	18 (2.8)	17 (2.8)	22 (3.4)	19 (3.2)
White bass	3 (0.9)	2 (0.8)	2 (1)	2 (1.2)	2 (0.8)
White crappie	<1 (0.2)	<1 (0.4)	<1 (0.1)	<1 (0.1)	<1 (0.04)
White sucker	0	<1 (0.1)	0	<1 (0.1)	0
Yellow perch	1 (0.3)	2 (0.7)	3 (1.2)	2 (0.7)	1 (0.3)

Seventeen species of small littoral fishes were collected by shoreline seining in 2008. All species had been previously sampled in Lake Sharpe. Gizzard shad comprised the majority of the catch in 2008, with a mean CPUE of 1,620 fish/haul (Table 5). Age 0 walleye CPUE for shoreline seining was 2. Mean CPUE for other species captured during the seining survey was within ranges previously documented. Caution should be used when making inferences about seining catch data. Highly variable catch rates are indicative of the gear type, and values may not represent the true population (Lyons 1986, Parsley et al. 1989).

Table 5. Mean catch per unit effort (CPUE; No./haul) and standard error (SE) values for fish species collected during the standard August seining survey on Lake Sharpe, South Dakota, 2004-2008. Catches are for age-0 fishes except where noted. Asterisk (*) indicates both age-0 and adult fish included in CPUE.

	2004	2005	2006	2007	2008
Bluegill	0	<1 (0.2)	0	0	0
Bluntnose minnow	0	2 (0.9)	2 (0.8)	3 (1.3)	4 (1.8)
Brassy minnow*	0	0	<1 (0.1)	0	0
Channel catfish	0	<1 (0.2)	<1 (0.3)	1 (1.1)	<1 (0.1)
Common carp	<1 (0.2)	<1 (0.3)	<1 (0.1)	<1 (0.1)	<1 (0.1)
Emerald shiner*	28 (9.4)	95 (40)	24 (8.4)	10 (4.6)	29 (7.6)
Freshwater drum	3 (1.7)	22 (8.8)	6 (2.1)	12 (6)	22 (8)
Gizzard shad	379 (147)	285 (84)	351 (136)	176 (55)	1,620 (640)
Goldeye	0	<1 (0.1)	0	0	7 (3.5)
Johnny darter*	<1 (0.2)	<1 (0.1)	<1 (0.5)	<1 (0.3)	<1 (0.5)
Largemouth bass	<1 (0.1)	<1 (0.1)	<1 (0.3)	<1 (0.1)	<1 (0.3)
River carpsucker	<1 (0.1)	11 (4.8)	<1 (0.1)	3 (1.6)	16 (9)
Sauger	0	<1 (0.4)	0	0	0
Smallmouth bass	2 (0.9)	2 (0.5)	4 (1)	3 (0.9)	8 (1.7)
Spottail shiner*	6 (2)	4 (1)	5 (2)	6 (1.9)	5 (1.2)
Walleye	0	4 (1.4)	<1 (0.2)	1 (0.5)	2 (0.6)
White bass	19 (8.5)	7 (2.8)	6 (2.7)	2 (0.6)	75 (51)
White crappie	11 (10)	3 (1.8)	2 (0.8)	2 (1)	<1 (0.1)
White sucker	<1 (0.1)	<1 (0.1)	0	<1 (0.1)	<1 (0.1)
Yellow perch	4 (1.5)	25 (11)	14 (5.2)	19 (5.3)	10 (4.4)

Population Parameters for Walleye

The length frequency for walleye collected in 2007 and 2008 is depicted in Figure 2. Multiple year classes were present in the 2008 sample with numerous walleye between stock and quality length. Walleye between 100 and 200 mm in length were not as abundant in the 2008 sample; however this size class was highly abundant during the fall age 0 walleye survey. Approximately 21% of walleye in the 2008 gill net sample were ≥ 380-mm (15-inch minimum length), 4% were ≥ 460-mm (18 inches), and 1% were ≥ 508-mm (20 inches).

Mean walleye CPUE for individual sampling locations are based on six net sets at each location, each year. Because Lake Sharpe is a flow through reservoir, flow characteristics highly influence daily and seasonal fish movement, distribution, and netting efficiency. Variability among gill net catches within and among survey years is due to changes in fish abundance, fish activity in association to current, and fouling of nets with debris in current or shallow-water areas. Current affects netting efficiency at the upper three sampling locations on Lake Sharpe (Figure 1) with nets at the DeGrey and Farm Island locations being the most affected. The low gill net catch rate for walleye at DeGrey in 2005 and 2006 are examples of nets being fouled by debris moved

about by wave action and current. Curly-leafed pondweed *Potamogeton crispus* and Eurasian watermilfoil *Myriophyllum spicatum* have become a problem in certain areas of Lake Sharpe and have affected catch rates of gear deployed in current areas.

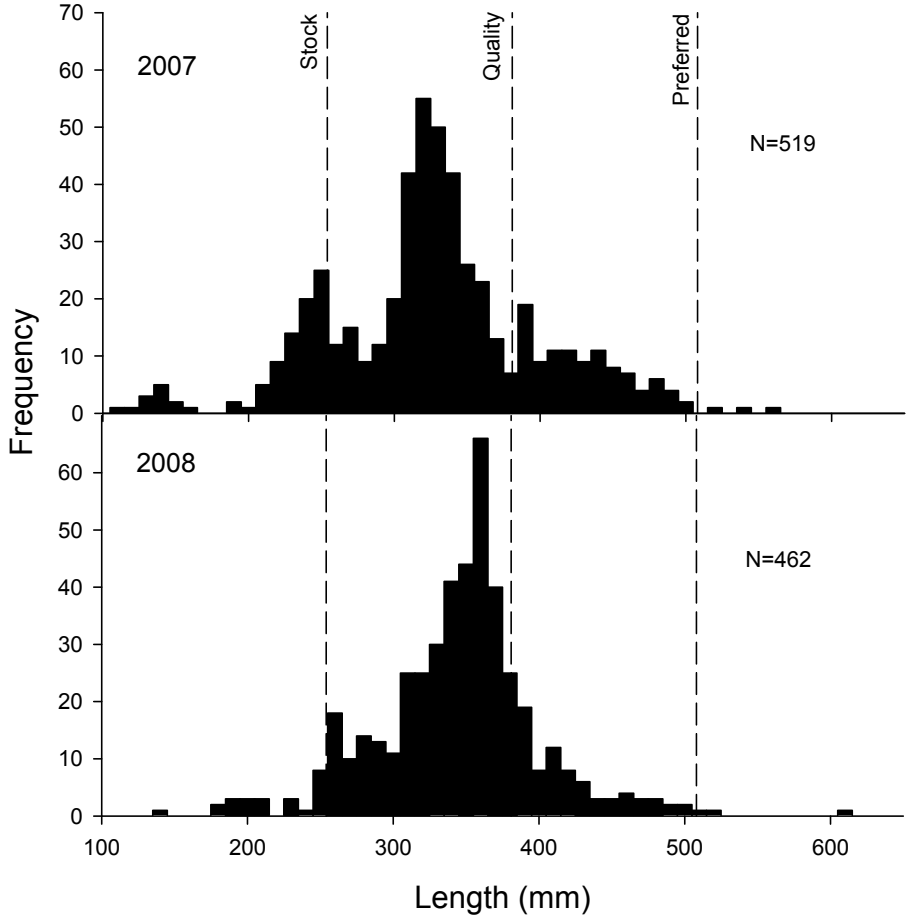

Figure 2. Length frequency of walleye collected in standard gill-net sets in Lake Sharpe, South Dakota, during August 2007 and 2008.

The strong 2005 and 2006 walleye year classes remained evident in 2008 gill net surveys (Figure 3). With above average abundance for year classes produced in 2007 and 2008 and the possibility of slowed growth, monitoring of growth is crucial in upcoming years. Stock density indices were similar in 2008 compared to the previous year (Table 6). While sauger abundance is not as high as walleye abundance (Table 4), stock density indices for sauger are generally extremely high in Lake Sharpe with a PSD in 2008 of 96 (Table 6).

Relative weight values for Missouri River reservoirs are generally between 80 and 90. Walleye relative weight for Lake Sharpe in 2008 was 84, similar to the five year average (Table 7). Variability in relative weights in Lake Sharpe occurs due to the seasonal availability of gizzard shad.

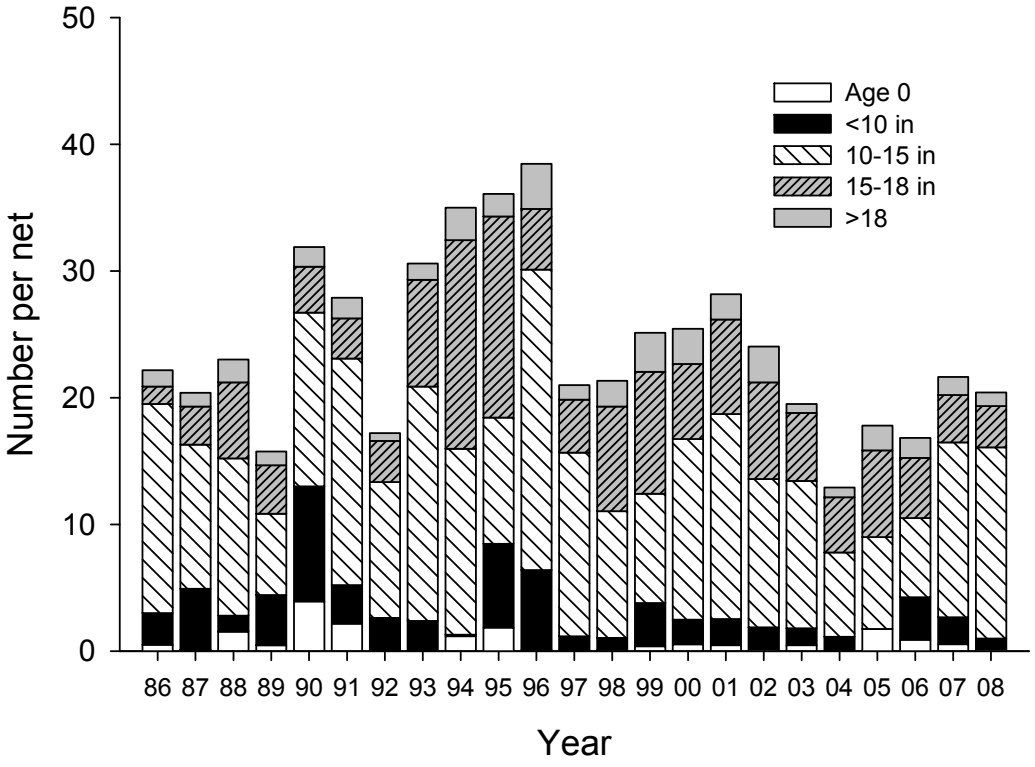

Figure 3. Size structure and abundance (CPUE) of walleye collected in the standard gill net survey in Lake Sharpe, South Dakota, during August, 1986-2008.

Table 6. Walleye and sauger proportional stock density (PSD) and relative stock density of preferred- (RSD-P) and memorable-length (RSD-M) fish collected during the standard gill net survey on Lake Sharpe, South Dakota, 2003-2008.

Year	Walleye				Sauger			
	PSD	RSD-P	RSD-M	Ns	PSD	RSD-P	RSD-M	Ns
2003	34	1	0	426	100	33	2	57
2004	37	0	0	303	82	37	0	68
2005	55	2	0	384	100	59	0	41
2006	48	2	0	339	52	37	0	54
2007	24	1	0	455	77	18	0	61
2008	27	4	0.4	472	96	34	0	100

Table 7. Mean walleye relative weight (*Wr*) values, by length group, for Lake Sharpe, South Dakota, 2003-2008. N is the number of stock-length fish in a sample.

Year	Length group							
	Stock-quality		Quality-preferred		Preferred-trophy		Total sample	
	Wr	N	*Wr*	N	*Wr*	N	*Wr*	N
2003	78	280	72	140	66	6	75	426
2004	87	143	84	156	76	4	85	303
2005	86	174	86	204	80	6	86	384
2006	86	174	84	156	70	7	85	337
2007	83	341	80	108	79	3	82	452
2008	86	345	81	98	78	3	84	446

Beginning in 2002, otoliths were removed from the majority of walleye and sauger collected during the August gill net survey. Prior to otolith removal, aging was solely based on age estimates generated from scale interpretation. Mean length at age at capture for each age group of walleye is illustrated in Table 8. Most individuals in the 2006 year class should surpass the 381-mm minimum length limit during the upcoming angling season with some surpassing the minimum in 2010 (Table 8). The change in mean length of fish in a year class from one year to the next is considered the annual growth increment for that year class (Table 9). While not statistically tested, growth for walleye through age 6 appears to have been slower during the 2002-2003 growth periods than during any subsequent period. Low relative weight values for walleye in the 2003 gill net survey (Table 7) may be indicative of slower growth during the 2002-2003 periods.

Age-3 walleye (i.e., produced in 2005) comprised the largest percentage of the 2008 gill net sample of any age group (Table 10). Only one age-0 walleye was captured during the gill net survey in 2008, however, fall night electrofishing catch of age-0 walleye was the highest year recorded since the survey began (Table 11). The 2005 and some faster growing individuals of the 2006 year class will reach the 15 inch minimum length limit during 2009.

Table 8. Mean length-at-age-at-capture (mm) for walleye collected in the standard August gill net survey, 2004-2008, on Lake Sharpe, South Dakota, and aged from otoliths.

Year		Length at age at capture (mm)								
		1	2	3	4	5	6	7	8	9
2004	Mean	252	312	370	390	401	437	441	495	506
	N	38	32	81	73	34	24	3	2	8
	SE	3.4	3.9	3.1	3.2	5.0	6.0	14.2	23.5	24.2
2005	Mean	282	342	379	407	427	438	465	467	476
	N	12	130	38	71	66	33	19	2	2
	SE	2.4	1.7	3.0	3.2	3.9	5.5	11.2	25.5	2.0
2006	Mean	263	360	392	410	442	439	456	462	422
	N	174	12	78	22	26	37	10	10	2
	SE	1.6	6.0	3.0	7.5	7.1	6.7	13.9	9.5	61.5
2007	Mean	251	336	392	419	425	434	451	441	468
	N	101	234	11	25	12	17	16	9	9
	SE	2.2	1.3	5.1	5.0	14.7	7.3	9.4	5.2	8.3
2008	Mean	253	326	379	393	435	406	461	477	-
	N	51	108	117	4	14	3	7	3	-
	SE	4.3	2.7	2.3	10.1	12.6	6.8	13.0	30.7	-
Mean of means		254	330	375	400	421	440	455	479	474

Table 9. Mean annual growth (length) increment estimates for walleye collected in the standard experimental coolwater gill net survey on Lake Sharpe, South Dakota, for the 2002-2003, 2003-2004, 2004-2005, 2005-2006, 2006-2007 and 2007-2008 periods, as determined by aging otoliths.

Year	Growth increment added during period (mm)							
	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9
2002-2003	64	35	12	0	2	--	--	--
2003-2004	88	59	28	16	27	15	56	26
2004-2005	90	67	37	37	37	28	26	--
2005-2006	78	50	31	35	12	18	--	--
2006-2007	73	32	27	15	8	12	17	--
2007-2008	75	43	1	16	--	27	26	--

Table 10. Age distribution of walleye collected from Lake Sharpe, South Dakota, 2004-2008, with standard gill net sets as determined by aging otoliths.

Year	Age												
	0	1	2	3	4	5	6	7	8	9	10	11	12
2004	1	37	30	81	73	35	23	3	2	8	4	0	0
2005	42	12	131	39	72	66	33	19	2	2	1	6	0
2006	21	175	12	80	23	26	37	10	10	2	1	2	3
2007	13	110	289	11	25	12	17	16	9	9	2	0	4
2008	1	51	108	117	4	13	3	7	3	2	0	0	0

Walleye recruitment, as indexed by fall nighttime electrofishing CPUE of age-0 fish, was higher in 2008 than any other year since the survey began in 1995 (Table 11; Lott et al. 2003). Age 0 walleye CPUE was 96 fish/h in 2008, indicating the presence of three above average walleye year classes (average=42) produced in Lake Sharpe. Mean length of age-0 walleye in the 2008 fall electrofishing catch, at 156 mm, was within the range previously observed.

Table 11. Mean nighttime electrofishing catch per unit effort (CPUE; No./h) and total length (mm) for age-0 walleye collected during September and October 2003-2008 on Lake Sharpe, South Dakota. SE is standard error values about means and N is sample size.

	Catch per unit effort (No./h)			Mean length (mm)		
Year	**CPUE**	**N**	**SE**	**Length**	**N**	**SE**
2003	20	36	5.7	166	177	0.2
2004	5	36	1.4	167	44	3.2
2005	88	36	12.6	171	793	4.9
2006	46	36	5.0	155	372	1.0
2007	30	36	4.2	169	272	1.18
2008	96	36	11	156	868	0.6

Population Parameters for Sauger

Sauger and walleye are managed with the same set of regulations since they are hard for anglers to differentiate and sauger are a very important part of the fishery in Lake Sharpe. Sixty three sauger were collected during the gill net survey in August 2008, for a mean CPUE of 3 fish/net night (Table 4). Sauger CPUE in 2008 was similar to the five year average (3 fish net/night). No age-0 sauger were collected while shoreline seining in 2008 (Table 5). Three age-0 sauger were collected during fall electrofishing in the 2008 survey. Overall condition (mean *Wr*) for sauger greater than stock length in the 2008 gill net survey was 72 and mean length-at-age-at-time-of-capture values for fish in the 2008 sample are presented in Table 12. Sauger up to age 4 were collected in the 2008 gill net survey, with the mean age of sauger captured being 2.3 years and the largest portion of the sampled sauger coming from the 2006 year class (age-2 fish, Table 13). Sauger collected during the gillnet survey ranged from 290 to 460 mm (Figure 4) and no sub-stock fish were captured.

Table 12. Mean length-at-age-at-capture (mm) values for sauger collected in the standard August coolwater gill net survey, 2004-2008, on Lake Sharpe, South Dakota, as determined by aging otoliths.

Year		Length at age at capture (mm)								
		1	2	3	4	5	6	7	8	9
2004	**Length**	260	315	353	379	410	414	--	--	--
	N	9	6	8	31	5	8	--	--	--
	SE	3.1	11.7	17.7	4.2	10.5	15.8	--	--	--
2005	**Length**	--	343	396	415	398	411	395	--	--
	N	--	16	6	1	9	3	6	--	--
	SE	--	4.0	12.4	--	4.9	12.0	7.5	--	--
2006	**Length**	254	359	391	375	--	408	--	480	--
	N	25	1	15	1	--	10	--	1	--
	SE	4.7	--	5.3	--	--	10.8	--	--	--
2007	**Length**	249	328	395	412	423	420	--	--	--
	N	11	38	4	5	2	1	--	--	--
	SE	6.0	3.8	14.0	19.9	17.7	0.0			
2008	**Length**	--	340	379	426	--	--	--	--	--
	N	--	24	19	1	--	--	--	--	--
	SE	--	4.9	6.6	426	--	--	--	--	--
Mean of means		254	337	383	401	410	413	--	--	--

Table 13. Age distributions of sauger collected from Lake Sharpe, South Dakota, 2003-2008, with gill nets during standard surveys.

Year	Age										
	0	1	2	3	4	5	6	7	8	9	10
2003	0	0	2	21	16	8	0	0	0	2	0
2004	0	8	4	8	28	5	8	0	0	0	1
2005	0	0	16	6	1	9	3	6	0	0	0
2006	0	26	1	15	1	0	10	0	1	0	0
2007	1	11	38	4	5	2	0	1	0	0	0
2008	0	0	24	19	1	0	0	0	0	0	0

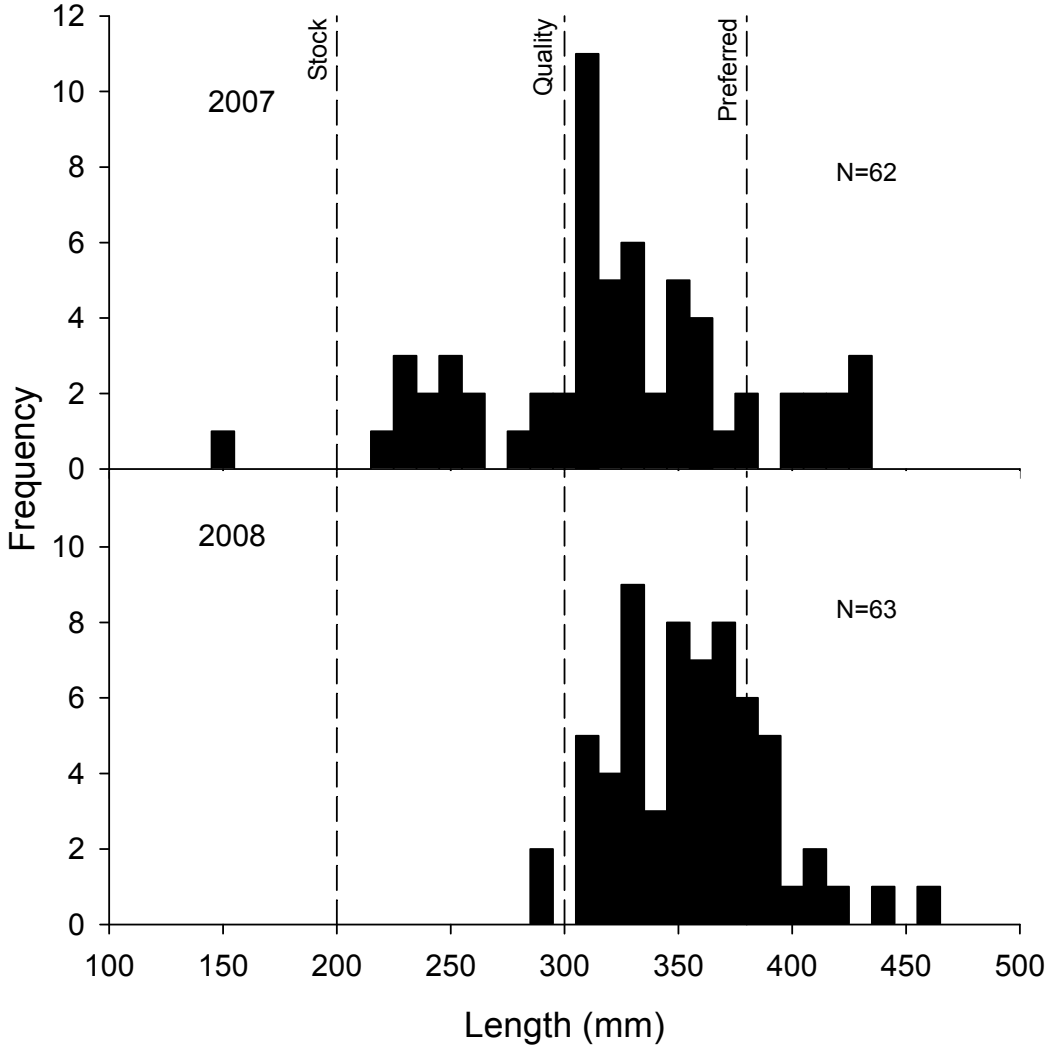

Figure 4. Length frequency of sauger collected during the standard gill net survey during August 2007 and 2008, on Lake Sharpe, South Dakota.

Population Parameters for Smallmouth Bass

Beginning in 2002, one rip-rap area (Big Bend Dam) and one natural habitat area (Joe Creek) have been sampled every week to 10 days during late-May and early-June, (three dates, six 15 minute runs per site) by nighttime electrofishing. Prior to 2002, sampling locations were sampled once each year and six, 15-minute runs were conducted. Mean CPUE has always been higher at Big Bend Dam than at Joe Creek, however, PSD, RSD-P, and RSD-M values are higher at Joe Creek (Table 14). For example, PSD at Big Bend Dam in 2008 was 54, while at Joe Creek it was 89. This pattern of higher catch rates and lower stock density indices values for rip-rap areas was also documented for Lake Oahe (Lott 1996, Lott 2000). Figure 5 illustrates the size structure of smallmouth bass collected at Big Bend Dam and Joe Creek.

Mean back-calculated length at age 4 (2004 year class) in 2008 was 342 mm (Table 15). Mean back-calculated length at age-4 for the statewide mean and Missouri River reservoirs are 300 and 299 mm, respectively, according to Willis et al. (2001). In 2008, length at age 4 for Lake Sharpe smallmouth bass was faster than the statewide and Missouri River reservoir averages. Mean length at time of capture in 2008 was similar to the previous three years (Table 16).

Beginning in 2004, a sample of approximately 100 smallmouth bass were collected, and aged by otoliths, each year. This sample was collected with the use of short term monofilament gill net sets at West Bend during July in 2005-2008. Previous sampling revealed mean length at capture determined from aging otoliths and scales were similar (Lott et al. 2007). Mean lengths at capture for age-3, 4, 5, and 6 were similar for the two aging structures. For smallmouth bass up to age 6, scales are a viable aging structure and allow age determination without sacrificing fish.

Table 14. Mean smallmouth bass electrofishing catch-per-unit effort (CPUE; No./h), proportional stock density (PSD), relative stock density of preferred-length (RSD-P) and memorable-length (RSD-M) fish values, for spring, nighttime electrofishing samples at Joe Creek and Big Bend Dam, Lake Sharpe, 2004-2008. N is number of electrofishing runs, SE is standard error.

Location	Year	CPUE	N	SE	PSD	RSD-P	RSD-M
Joe Creek	2004	18	18	4.9	60	14	0
	2005	12	12	3.8	67	12	0
	2006	30	18	6.9	68	25	1
	2007	21	18	4.7	33	11	0
	2008	12	18	4.4	87	24	1
Big Bend Dam	2004	66	18	16.4	25	3	0
	2005	61	18	15.4	40	10	1
	2006	105	18	28.0	22	6	0
	2007	57	18	15.2	25	10	0
	2008	45	18	11	55	26	5

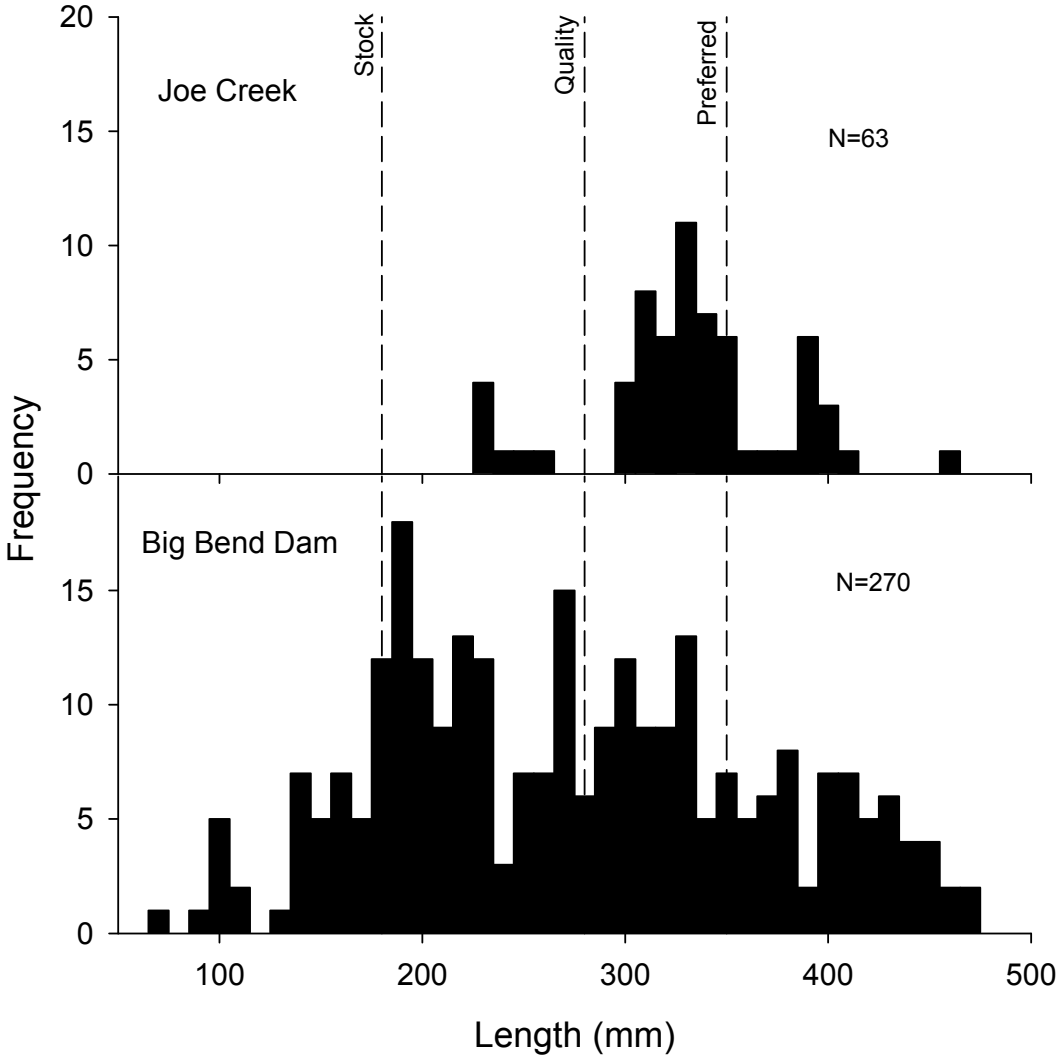

Figure 5. Length frequency of smallmouth bass collected with nighttime shoreline electrofishing, by site, during May and June 2008 on Lake Sharpe, South Dakota.

Table 15. Mean back-calculated total lengths (mm) at annulus and length increments for each year class of smallmouth bass collected from Lake Sharpe, South Dakota, by nighttime electrofishing during May and June 2008, as determined from scales. N is the number of fish of each age in the sample.

Year class	Age	N	Annulus								
			1	2	3	4	5	6	7	8	9
2007	1	27	159								
2006	2	103	98	212							
2005	3	110	96	206	304						
2004	4	32	81	192	292	354					
2003	5	25	94	188	294	349	387				
2002	6	25	83	191	274	344	388	415			
2001	7	8	88	197	285	336	389	422	438		
1999	9	2	105	217	253	327	358	388	426	444	456
Sample mean			100	200	284	342	381	408	432	444	456
Standard error			9	4	7	5	8	10	6		
Length increment			100	83	58	39	28	24	12	12	
Statewide mean			91	171	242	300	333				
Missouri reservoir mean			88	171	246	299	337				

Table 16. Mean length-at-age-at-capture (mm) for smallmouth bass collected during July at West Bend, 2005-2008, on Lake Sharpe, South Dakota, and aged from otoliths.

Year		Length at age at capture (mm)								
		1	2	3	4	5	6	7	8	9
2005	**Mean**	183	226	257	332	354	374	389	--	--
	N	1	15	43	31	26	6	6	--	--
	SE	--	4.7	5.1	2.9	15.7	5.2	7.2	--	--
2006	**Mean**	--	--	227	293	357	387	404	422	419
	N	--	--	20	29	11	12	11	3	2
	SE	--	--	8.2	7.8	8.9	4.2	4.9	15.3	6.5
2007	**Mean**	--	275	315	358	383	402	414	432	433
	N		47	9	11	14	13	7	2	3
	SE		3.8	7.8	3.8	5.2	4.2	5.0	10.5	6.7
2008	**Mean**	--	253	310	357	381	399	406	426	425
	N	--	18	33	25	30	17	15	7	3
	SE	--	4.1	4.1	4.1	3	3.3	5.6	7.5	13.9
Mean of means		183	251	277	335	369	391	403	427	426
Statewide mean		91	171	242	300	333				
Missouri River mean		88	171	246	299	337				

Mean smallmouth bass *Wr* values in the spring electrofishing survey for Lake Sharpe in 2008 ranged from 84-99 for fish in the sub-stock through memorable-to-trophy length groups (Table 17). As the size of bass increases, condition generally decreases in Lake Sharpe and 2008 was no exception. Preferred-to-memorable-length fish had a mean *Wr* of 89 in 2008, compared to mean *Wr* values of 96 and 93 for stock-to-quality- and quality-to-preferred-length fish, respectively.

Table 17. Mean relative weight (Wr), by length class, for Lake Sharpe smallmouth bass collected by electrofishing during May and June, 2004-2008. N is the number of fish used in calculations.

Year	Sub-stock		Stock-to-Quality		Quality-to Preferred		Preferred- to Memorable		Memorable-to Trophy	
	Wr	**N**	***Wr***	**N**	***Wr***	**N**	***Wr***	**N**	***Wr***	**N**
2004	93	35	94	149	91	72	81	15	---	0
2005	97	79	89	110	90	68	83	18	83	2
2006	96	54	97	162	93	83	89	40	94	1
2007	100	25	96	212	93	51	90	30	---	0
2008	100	35	97	110	93	107	90	59	84	13

The current smallmouth bass regulation on Lake Sharpe restricts anglers from harvesting bass between 356 and 457 mm. Electrofishing has been documented to under-represent population size structure for smallmouth bass (Green et al. 1986; Beamesderfer and Riemer 1988), meaning standard sampling techniques may not adequately sample the larger fish in a population. Therefore, Game, Fish, and Parks worked with the South Dakota Bass Anglers Sportsmen Society (BASS) Federation to collect lengths and weights from fish caught during the BASS Championship tournament conducted on September 27th and 28th, 2008. A total of 405 smallmouth bass on day one and 414 smallmouth bass on day two were brought into the weigh-in site. Game, Fish and Parks staff weighed (grams) 250 and measured (TL, mm) 500 smallmouth bass during the two day tournament. Of the smallmouth bass with length and weight taken, 205 fish were within the memorable-trophy length group with a mean *Wr* of 93. Figure 6 illustrates the sizes of smallmouth bass collected during the tournament in 2006-2008.

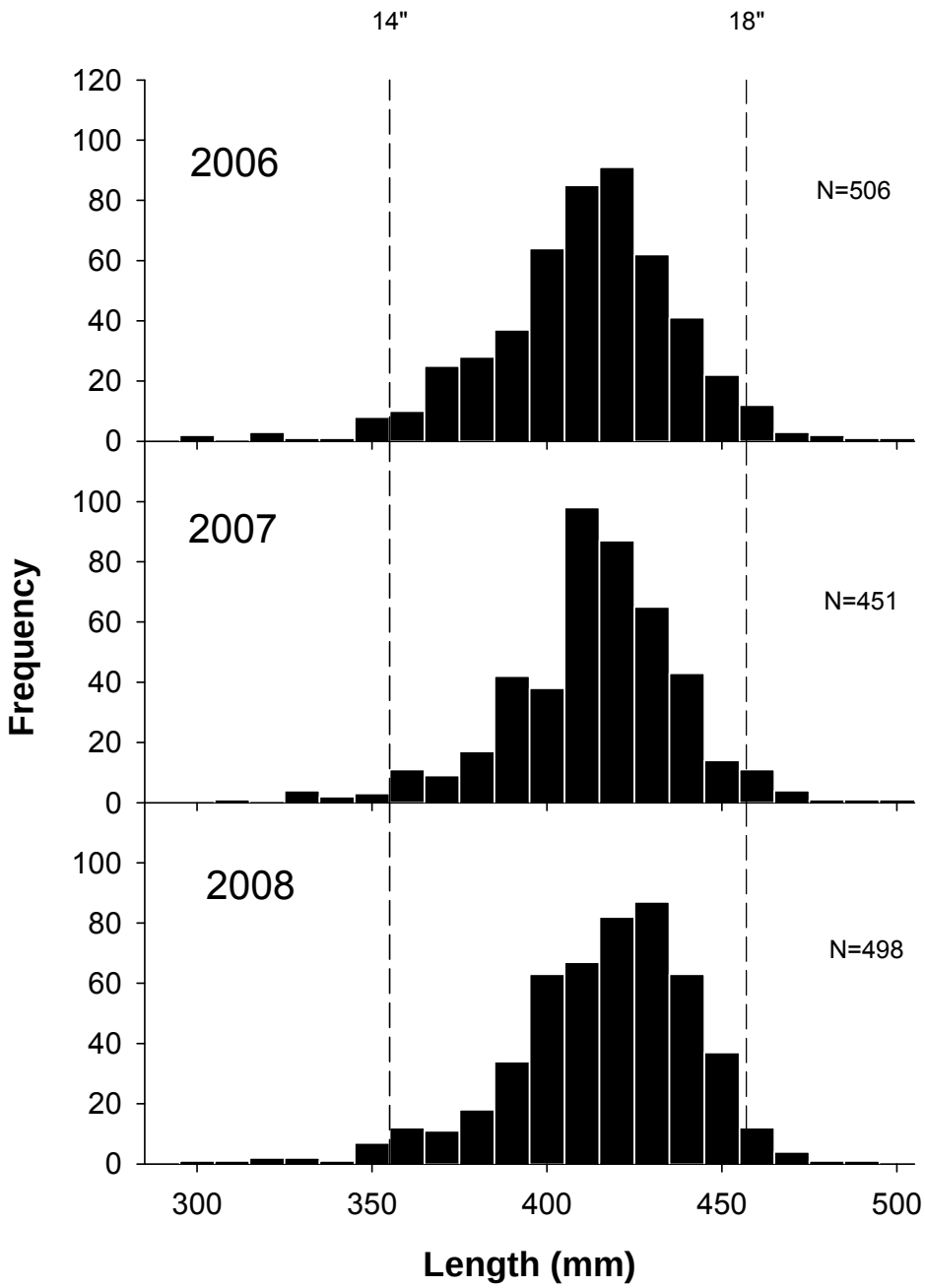

Figure 6. Length frequency for smallmouth bass caught during the SD BASS Championship tournament during 2006-2008.

Population Parameters for Channel Catfish

Most channel catfish population indices (RSD-P, RSD-M, and *Wr*) exhibited little change during the 2004-2008 period (Table 18). Channel catfish PSD increased from 25 in 2004 to 60 in 2008. Channel catfish CPUE (no./net-night) of 5 during 2008 was below the five year average (average=10 *in* Table 4). Heavy vegetation in the gear at the standard sites may have been a factor that influenced low catch rates in 2008. Figure 7 illustrates the length frequency for 2007 and 2008 period for channel catfish gill net samples. Growth and age structure data from 2003 and 2008 are presented in Table 19 illustrating that channel catfish are long lived but grow slowly in Lake Sharpe (Lott et al 2004) which may explain the limited changes in population indices over time. Growth rates have slowed since the closure of Big Bend Dam in 1963. Elrod (1974) documented a gradual reduction in growth rates during the first eight years following impoundment of the reservoir. Due to slow growth, age structures (pectoral spines) will be collected every five years on Lake Sharpe with the next year of collection being in 2013.

Table 18. Channel catfish proportional stock density (PSD), relative stock density of preferred and memorable-length (RSD-P and RSD-M) fish, and relative weight (*Wr*) for 2004-2008, from Lake Sharpe, South Dakota. Mean *Wr* values are for stock-length fish only.

Year	PSD	RSD-P	RSD-M	*Wr*	N
2004	25	0	0	85	259
2005	39	1	0	86	146
2006	52	1	0	81	157
2007	64	2	0	81	116
2008	60	2	0	83	132

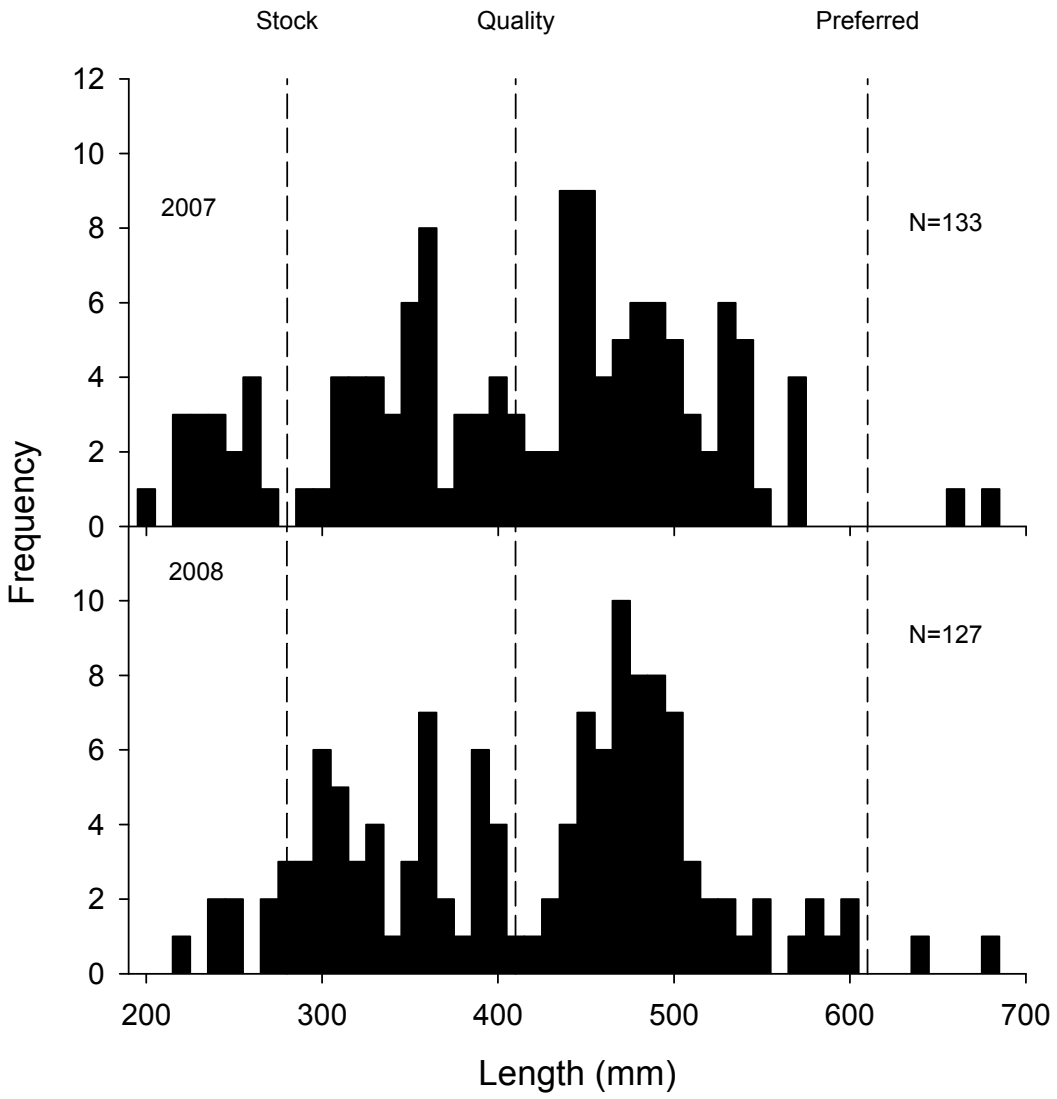

Figure 7. Length frequency of channel catfish collected during the standard, coolwater gill net survey during August 2007 and 2008, on Lake Sharpe, South Dakota.

Table 19. Mean length-at-age-at-capture (mm) for channel catfish collected during July at West Bend, 2003 and 2008, on Lake Sharpe, South Dakota, and aged from pectoral spines. N is the number of fish of each age in the sample. SE is standard error.

Age	2003			2008		
	Length	N	SE	Length	N	SE
1	--	--		243	1	--
2	219	1	5	288	9	7
3	320	3	9	298	10	12
4	278	10	11	326	5	19
5	298	26	10	401	1	--
6	333	75	11	418	3	19
7	346	18	12	--	0	--
8	334	9	13	422	11	16
9	364	3	13	436	27	20
10	406	6	12	489	22	12
11	477	16	12	473	7	13
12	435	8	14	530	5	24
13	541	8	11	545	3	35
14	595	5	14	519	2	29
15	555	3	13	640	1	--
16	600	3	12	584	2	3
17	608	4	12	--	--	--
18	625	3	14	--	--	--
19	590	2	11	--	--	--
20	716	1	14	--	--	--

ANGLER USE, SPORTFISH HARVEST, AND PREFERENCE SURVEYS

Angler Use

A total of 1,281 angling parties were interviewed during the April-September 2008 daylight angler use and harvest survey. Estimated fishing pressure for the April-September 2008 daylight period, at 316,726 angler-h, was similar to the 2007 estimate of 335,017 angler-h (Table 20). Estimated angler days spent on Lake Sharpe during the 2008 survey period was 95,113 days, a value below the reservoir-wide objective of 100,000 angler days (SDGFP 1994).

Table 20. Angler use and harvest estimates for surveys conducted on Lake Sharpe, South Dakota. All surveys were conducted during the April-September daylight period, except where noted.

Year	Fishing pressure (h)	Angler trips	Estimated fish harvest	Estimated walleye harvest	Reference
1973-1974*	208,800	46,400	76,813	62,479	Schmidt (1975)
1984	241,986	52,605	87,020	64,784	Riis (1986)
1985	274,376	62,358	123,942	66,584	Riis (1986)
1991	303,381	70,554	143,307	93,027	Fielder et al. (1992)
1992	402,543	100,636	219,152	157,220	Stone et al. (1994)
1993	291,970	60,827	102,833	83,133	Stone et al. (1994)
1994	347,125	91,752	152,981	130,009	Riis & Johnson (1995)
1995	356,391	122,893	166,949	140,943	Riis et al. (1996)
1996	477,220	101,536	170,568	142,506	Riis et al. (1997)
1997	442,827	100,097	191,079	159,274	Johnson et al. (1998)
1998	502,631	111,696	252,496	207,144	Johnson and Lott (1999)
1999	386,315	84,784	186,720	155,724	Johnson and Lott (2000)
2000	325,532	71,893	144,730	104,076	Johnson and Lott (2001)
2001	300,078	77,141	116,476	91,029	Johnson et al. (2002)
2002	385,357	90,459	196,600	141,612	Lott et al. (2003)
2003	397,220	99,305	140,796	105,275	Lott et al. (2004)
2004	309,663	87,475	108,869	60,375	Lott et al. (2006)
2005	271,331	75,370	110,500	56,535	Lott et al.(2007)
2006	342,974	99,702	142,209	110,443	Potter and Lott (2007)
2007	335,017	89,100	137,616	111,174	Potter et al. (2008)
2008	316,726	95,113	125,353	92,545	This report

* June 1973 through May 1974

The majority of the angling pressure on Lake Sharpe occurred in the lower zone in 2008 at nearly 174,000 angler hours (Table 21). Estimated angling pressure by reservoir zone on Lake Sharpe is often highest in lower Lake Sharpe (Table 21; Johnson and Lott 2001; Johnson et al. 2002; Lott et al. 2003). The upper zone of Lake Sharpe generally receives the highest angling pressure in May. However, in 2008, heavy run-off, mainly from the Bad River, combined with high winds led to extremely turbid conditions, which likely affected the number of angler hours during April and May. The middle zone receives the least pressure of any zone on Lake Sharpe. In 2008, approximately 8% of Lake Sharpe's angling pressure occurred in this zone with May receiving the most pressure of any month at approximately 12,000 angler hours. Peak fishing pressure for Lake Sharpe typically occurs in May or June (Johnson and Lott 2001; Lott et al. 2003, 2006b, 2007). This again occurred in 2008 with over 45% of the total angling pressure occurring during May and June.

Estimated hours of fishing pressure per ha during 2008 were 13.4, similar to 2007 (Table 22). Estimated number of boat angler hours decreased in 2008 while the number of shore angler hours increased with both boat and shore angler hours near the four year average (Table 23).

Table 21. Estimated fishing pressure (angler hours), by month and zone, with 80% confidence intervals (CI), for the April-September 2008 daylight period on Lake Sharpe, South Dakota.

Zone	Month						
	April	May	June	July	August	Sept.	Total
Lower	2,518	51,206	33,706	36,925	26,643	22,958	173,956
80% CI	1,097	15,145	6,519	7,038	7,350	6,839	20,577
Middle	2,856	12,022	4,348	1,591	653	4,200	25,670
80% CI	1,295	7,023	1,271	397	236	1,494	7,420
Upper	19,052	17,141	24,503	20,222	10,001	26,179	117,099
80% CI	8,672	4,494	6,752	5,799	1,802	5,585	22,106
Total	24,427	80,369	62,557	58,739	37,297	53,337	316,726
80% CI	8,837	17,288	9,472	9,128	7,571	8,956	26,221

Table 22. Estimated fishing pressure, expressed as angler-hours (h) and hour per hectare (h/ha), by reservoir zone, for standard creel surveys conducted during the April-September daylight period, on Lake Sharpe, South Dakota, 1999-2008.

Year	Zone							
	Lower		Middle		Upper		Total	
	h	h/ha	h	h/ha	h	h/ha	h	h/ha
1999	216,972	11.8	38,410	9.1	130,933	142.6	386,315	16.3
2000	187,469	10.2	51,778	12.2	86,285	94.0	325,532	13.8
2001	179,082	9.8	49,885	11.8	71,111	77.4	300,078	12.7
2002	180,568	9.8	91,401	21.6	113,388	123.5	385,357	16.3
2003	211,403	11.5	36,021	8.5	149,796	163.1	397,220	16.8
2004	124,860	6.8	34,773	8.2	150,030	163.4	309,663	13.1
2005	102,978	5.6	20,174	4.7	148,179	161.4	271,331	11.5
2006	143,410	7.8	30,064	7.1	169,500	184.6	342,974	14.5
2007	198,422	10.7	19,184	4.5	117,411	127.9	335,017	13.6
2008	173,956	9.4	25,671	6.0	117,099	127.5	316,726	13.4

Table 23. Estimated fishing pressure, expressed as angler-hours (h) and hours per hectare (h/ha), by type of fishing, with 80% confidence intervals (CI), for the standard April-September daylight survey period, on Lake Sharpe, South Dakota, 2005-2008.

Type of fishing	Year			
	2005	2006	2007	2008
Boat (h)	228,420	287,893	293,190	261,082
80% CI	29,535	35,044	50,757	24,150
H/ha	9.7	12.2	12.4	11.0
Shore (h)	42,911	55,082	41,827	55,644
80% CI	5,972	6,577	7,430	9,093
H/ha	1.8	2.3	1.8	2.4

Catch, Harvest and Release Estimates

An estimated 125,353 fish were harvested from Lake Sharpe during the April-September daylight period (Table 24). Estimated harvest of walleye during the 2008 survey period was 92,544 fish, below the Lake Sharpe strategic plan objective of 100,000 fish (SDGFP 1994). The most walleye harvested in any month during 2008 was in July when 28,827 were harvested. Smallmouth bass, white bass, channel catfish and sauger followed walleye, in terms of estimated total harvest in 2008. Smallmouth bass harvest of 14,803 is the highest estimated harvest since creel surveys began on Lake Sharpe. Estimated harvest of smallmouth bass in 2001 was 14,673 (Johnson et al. 2002).

Table 24. Estimated number of fish harvested, by species and month, with 80% confidence intervals (CI), for the April-September 2008 daylight period on Lake Sharpe, South Dakota.

Species	Month						
	April	May	June	July	Aug.	Sept.	Total
Walleye	5,761	20,838	6,068	28,827	15,614	15,437	92,544
80% CI	3,100	6,084	1,508	8,499	3,928	4,819	12,640
Sauger	546	1,144	240	13	215	248	2,406
80% CI	342	403	208	15	245	114	630
Channel catfish	184	1,098	753	1,529	566	607	4,737
80% CI	113	605	245	622	339	274	1,007
White bass	477	2,359	2,959	522	582	573	7,472
80% CI	227	814	1,362	335	359	391	1,729
Smallmouth bass	36	6,853	2,628	3,073	818	1,393	14,803
80% CI	41	3,049	625	1,273	427	736	3,469
Rainbow trout	161	18	35	0	0	21	236
80% CI	143	22	50	-	-	28	156
Yellow perch	20	0	149	108	50	227	555
80% CI	11	-	88	81	69	178	225
Other*	36	1,478	591	300	131	100	2,600
Total	7,185	33,789	13,423	34,373	17,977	18,606	125,353
80% CI	2,146	9,517	2,461	8,653	4,378	5,380	14,974

*Other includes black crappie, bluegill, common carp, freshwater drum, goldeye, green sunfish, largemouth bass, northern pike, and white crappie.

An estimated 360,307 fish were released during the April-September 2008 daytime period on Lake Sharpe (Table 25). Estimated number of walleye released (Table 25) and fishing pressure (Table 21) was highest during May and June when the 381-mm minimum length limit was in effect. An estimated 117,000 smallmouth bass were released during 2008 with nearly 50% of those released during May (Table 25).

Table 25. Estimated number of fish released, by species and month, for the April-September 2008 daylight period, on Lake Sharpe, South Dakota.

Species	Month						
	April	May	June	July	Aug.	Sept.	Total
Walleye	7,431	48,639	74,478	30,107	12,214	36,334	209,204
80% CI	3,900	16,471	16,984	7,171	3,554	9,257	26,921
Sauger	919	932	258	13	0	115	2,238
80% CI	597	455	106	15	--	58	760
Channel catfish	270	405	858	2,198	2,447	856	7,035
80% CI	253	197	369	1,021	1,502	335	1,911
White bass	218	4,291	3,793	998	693	2,168	12,160
80% CI	229	1,280	1,407	446	668	1,045	2,325
Smallmouth bass	2,557	52,635	24,672	16,241	4,526	17,021	117,651
80% CI	1,233	16,357	5,635	6,875	1,482	8,375	20,504
Rainbow trout	632	18	0	0	0	14	664
80% CI	709	22	--	--	--	0	710
Yellow perch	154	59	291	746	728	1,000	2,978
80% CI	149	33	138	346	330	392	652
Other*	646	1,341	2,101	1,245	1,941	1,103	6,264
80% CI							
Total	12,827	108,319	106,452	51,547	22,549	58,613	360,307
80% CI	3,865	31,370	21,889	13,699	5,062	14,326	43,551

*Other includes black bullhead, black crappie, bluegill, common carp, freshwater drum, goldeye, green sunfish, largemouth bass, northern pike, river carpsucker, shovelnose sturgeon, and white crappie.

Examination of Table 24 and Table 25 provide a complete picture of catch and harvest of sport fish species for the April-September 2008 survey period. Walleye were the most abundant species in the angler catch during 2008, with an estimated catch of 301,749 fish. Walleye were followed by smallmouth bass, white bass, channel catfish, and sauger, in decreasing order of estimated catch. Approximately 31% of walleye caught during 2008 were harvested, while percentages of fish harvested for smallmouth bass, white bass, channel catfish, and sauger were 11%, 38%, 40%, and 52%, respectively. The high percentage of smallmouth bass released was due, in part, to the 355-457-mm protected slot length limit that was implemented in 2007.

Estimated walleye harvest during the 2008 April-September standard survey period was highest in lower Lake Sharpe at 65,574 fish (71 %) with an estimated 23,703 walleye (26 %) harvested in upper Lake Sharpe (Table 26). Sauger, rainbow trout, and white bass harvest were the highest in the upper zone while smallmouth bass harvest was highest in the lower zone, of Lake Sharpe, with 89% of the estimated smallmouth bass harvest for the reservoir coming from the lower zone in 2008.

Table 26. Estimated number of fish harvested, for selected species, by zone, with 80% confidence intervals (CI), for the April-September 2008 daylight period, on Lake Sharpe, South Dakota.

Species	Zone			
	Upper	Middle	Lower	Total
Walleye	23,703	3,267	65,574	92,545
80% CI	6,194	550	11,006	12,641
Sauger	1,987	93	326	2,406
80% CI	614	86	110	630
Channel catfish	1,543	1,251	1,943	4,737
80% CI	690	473	561	1,007
White bass	4,580	1,152	1,740	7,427
80% CI	1,523	570	586	1,729
Smallmouth bass	1,516	64	13,223	14,803
80% CI	525	67	3,428	3,469
Rainbow trout	236	0	0	236
80% CI	156	--	--	156
Yellow perch	102	0	453	555
80% CI	168	--	149	225
Total	35,595	6,183	83,575	125,353
80% CI	7,052	1,516	13,122	14,974

Estimated numbers of walleye caught, harvested, and released during the standard April-September daylight survey period in 2008 was below average for the previous 15 year period (Table 27). The percentage of walleye caught that were harvested was 31% in 2008. Percent of walleye harvested was lower than average (average=40% *in* Table 27) in 2007 and 2008 due to the increase in abundance of smaller walleye from four consecutive years of above average reproduction (Table 27).

Table 27. Estimated number of walleye caught, harvested, and released during the April-September daylight period for Lake Sharpe, South Dakota, 1994-2008.

Year	Caught	Harvested	Released	Percent Harvested
1994	248,777	130,009	118,718	52
1995	237,615	140,943	96,656	59
1996	499,686	142,506	357,180	29
1997	365,493	159,274	206,219	44
1998	468,578	207,144	261,434	44
1999	348,087	155,724	192,363	45
2000	339,022	104,076	234,946	31
2001	332,904	91,029	241,874	27
2002	377,184	141,612	235,572	38
2003	528,520	105,275	423,244	20
2004	160,974	60,375	100,244	38
2005	98,794	56,535	42,259	57
2006	196,523	110,442	86,081	57
2007	340,733	111,174	229,560	33
2008	301,749	92,545	209,204	31

Length frequency distributions of walleyes harvested each month during the April-September 2008 daylight period illustrate standard trends for Lake Sharpe (Figure 8). Approximately 90% of the walleyes harvested during the months that the 381-mm minimum length limit was in effect were between 381 and 457-mm in length (15 and 18 inches). During July and August, when no minimum length limit was in effect, 14% of the walleyes harvested were between 381 and 457-mm in length and 85% were less than 381-mm during July and August. The percentage of walleye longer than 457 mm in length in the angler harvest was highest during April at 18% and ranged from 1% to 14% during other months in the April-September period. Approximately 8% of walleye harvested during the April-September survey period were 457-mm or longer (Figure 8). Beginning in 2006, the “one over” regulation was increased to 508 mm. In 2008, less than 1 percent of the April-September harvest exceeded 508 mm with monthly ranges from 0 to 2.5% occurring.

Length frequency histograms for smallmouth bass measured in the angler harvest in 2008 are shown in Figure 9. For the April-September 2008 daylight survey period, approximately 91% of the smallmouth bass harvested were <355-mm in length and 3% were ≥457-mm in length. Approximately 6% of the smallmouth bass measured during angler interviews were within the protected slot length limit (Figure 9).

Hourly Catch, Harvest, and Release Rates

Estimated hourly catch and release rates for all species combined for the April-September 2008 daylight period were 1.53 fish/h and 1.14 fish/h, respectively (Table 28). Estimated harvest rate, for all species combined, for 2008 was similar to the five year average. The catch rate for walleye dropped from 1.04 fish/angler-h in 2007 to 0.95 fish/angler-h in 2008. Catch rates for walleye in Lake Oahe and Lake Francis Case in 2007 were 0.64 and 1.25 fish/angler-h, respectively. The white bass catch rate has not returned to values found in the past (i.e., 0.31 in 2005, Lott et. al., 2007) due to the white bass die off that occurred during July 2005 (Lott et. al. 2007).

Table 28. Estimated hourly catch, harvest, and release rates, by species, for all anglers interviewed on Lake Sharpe, South Dakota, during the April-September 2008 daylight survey period. Trace (T) indicates values >0.0 but <0.01.

Species	Catch rate (fish/angler-h)	Harvest rate (fish/angler-h)	Release rate (fish/angler-h)
Walleye	0.95	0.29	0.66
Sauger	0.01	T	0.01
White bass	0.06	0.02	0.04
Smallmouth bass	0.42	0.05	0.37
Channel catfish	0.04	0.02	0.02
Rainbow trout	T	T	T
Yellow perch	0.01	T	0.01
Other*	0.03	T	0.03
Total	1.53	0.39	1.14

*Other includes black bullhead, black crappie, bluegill, common carp, freshwater drum, goldeye, green sunfish, largemouth bass, northern pike, river carpsucker, shovelnose sturgeon, and white crappie.

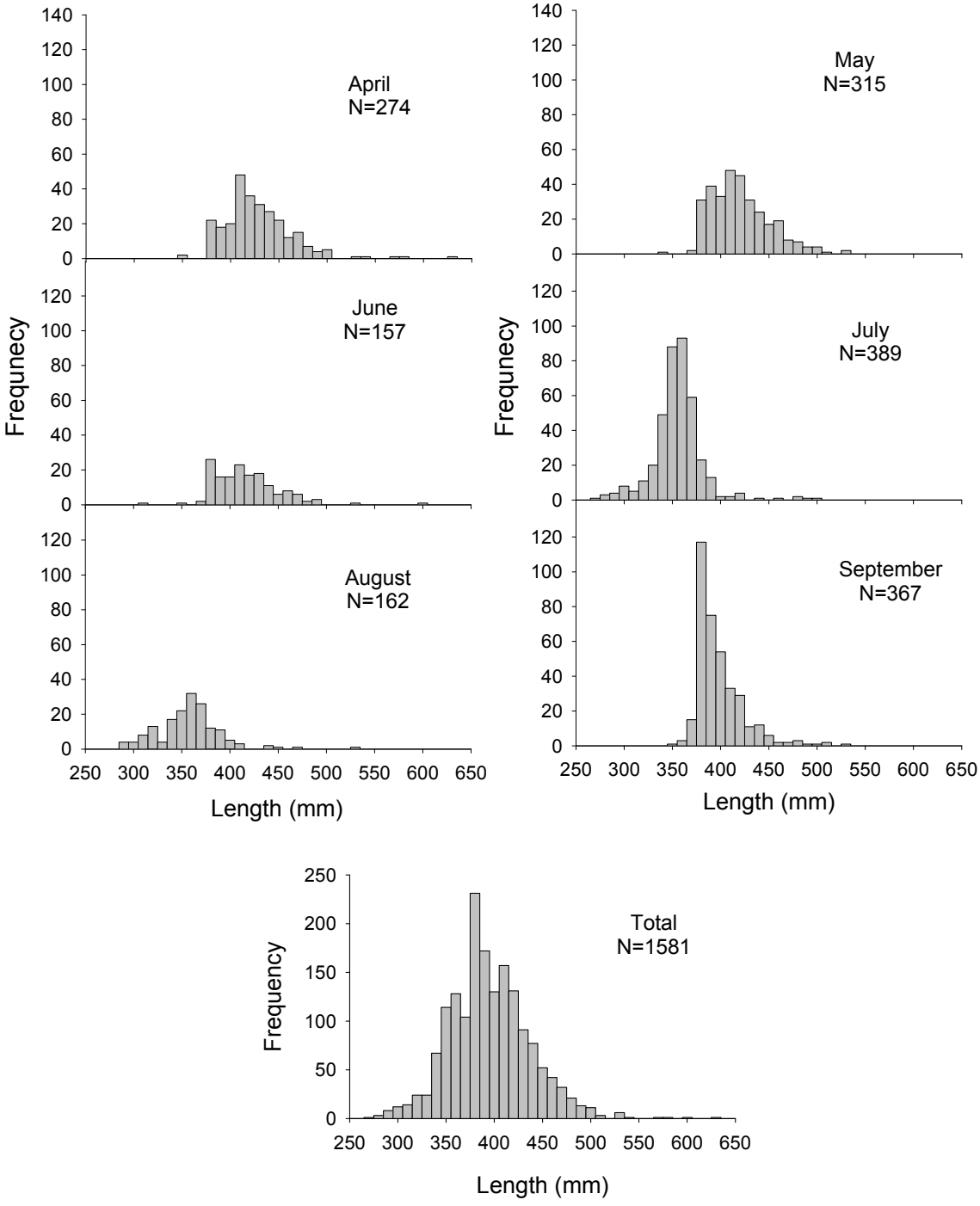

Figure 8. Length frequency distribution of walleye harvested by anglers, by month, fishing Lake Sharpe, South Dakota, during the April-September 2008 daylight period.

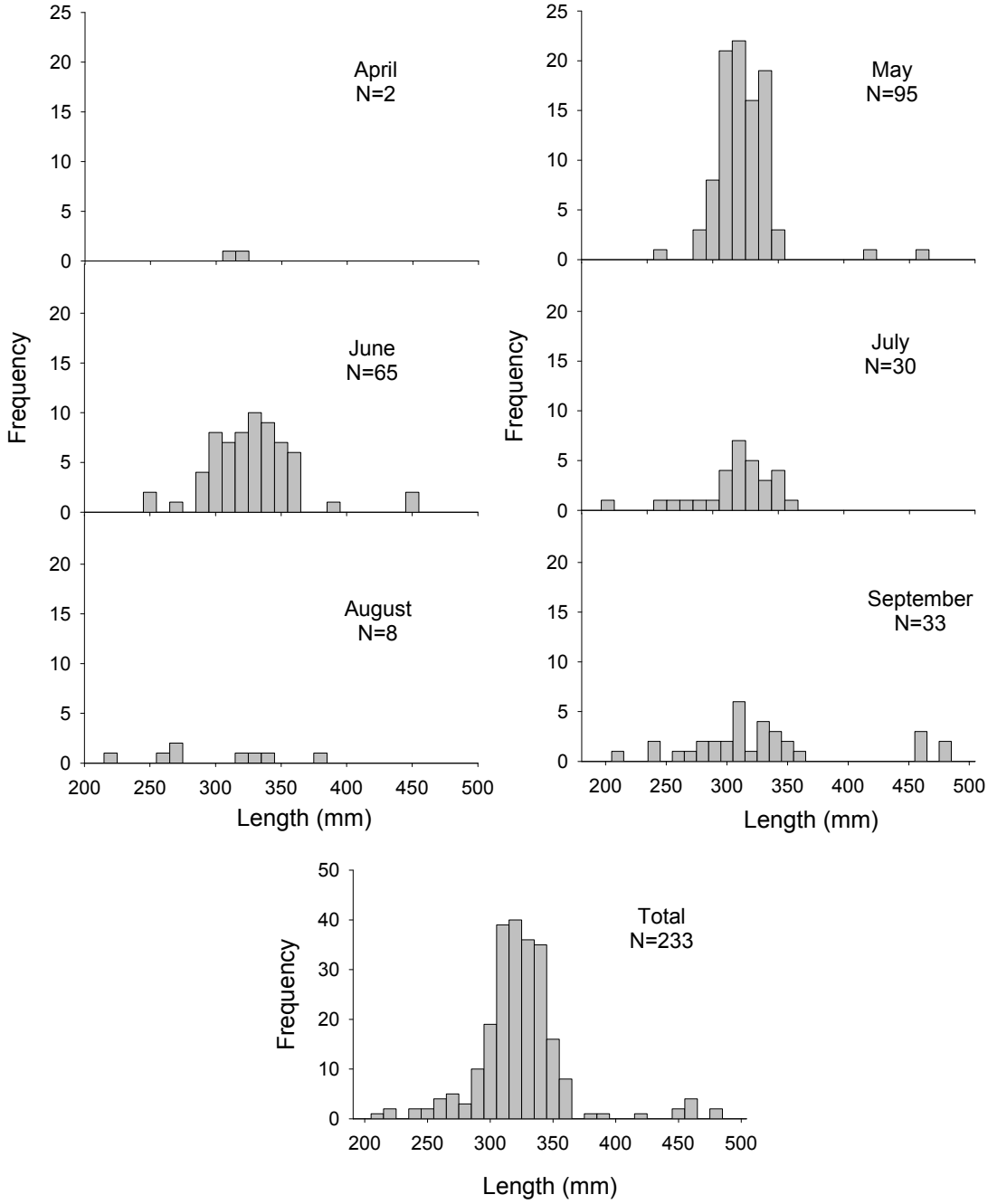

Figure 9. Length frequency distribution of smallmouth bass harvested by anglers fishing Lake Sharpe, South Dakota, by month, during the April-September 2008 daylight period.

For anglers specifically targeting a certain species, hourly catch, harvest, and release rates were substantially higher (Table 29) than those for all anglers combined (Table 28). Anglers specifically targeting walleyes had a mean hourly catch rate of 2.05 fish/angler-h for the April-September daylight period (Table 29), while the mean catch rate of walleyes by all anglers was 0.95 fish/angler-h (Table 28). Anglers specifically targeting smallmouth bass, white bass, and

channel catfish had mean hourly catch rates of 2.45, 1.67, and 1.1 fish/angler-h, respectively. The catch rate for anglers fishing specifically for white bass remained significantly lower in 2008, than years prior to the die-off (5.82 fish/angler-h in 2005, 9.53 fish/angler-h in 2004 in Lott et al. 2007).

Table 29. Estimated hourly catch, harvest, and release rates, by species, for anglers specifically fishing for the species listed, on Lake Sharpe, South Dakota during the April-September 2008 daylight period.

Species	Catch rate (fish/angler-h)	Harvest rate (fish/angler-h)	Release rate (fish/angler-h)
Walleye	2.05	0.63	1.42
White bass	1.67	1.61	0.06
Smallmouth bass	2.45	0.06	2.39
Channel catfish	1.10	1.06	0.04
Rainbow trout	3.79	0.44	3.35

Mean hourly catch rates for walleye, smallmouth bass, white bass, channel catfish, and all fish combined, for the April-September standard survey period, for 1993 through 2008, are presented in Table 30. The high hourly catch rate for walleye in 2003 was likely related to a high abundance of age-3 fish (2000 year class) and lower than average gizzard shad production. Low hourly catch rates for walleye from 2004 to 2006 were likely related to higher shad production, a decrease in walleye abundance (Table 6), and an increase in mean age of fish in the walleye population (Table 10). During 2008, the hourly catch rate of walleye in Lake Sharpe was 0.95 fish/angler-h, well above 0.3 fish/angler-h, a level indicative of an excellent walleye fishery according to Colby et al. (1979).

There is a general trend of increasing catch rates for smallmouth bass, channel catfish, and white bass during the 1993-2008 period (Table 30). Abundance of fish may influence hourly catch rates by anglers to some extent. However, it is likely that an increase in the percentage of total angling trips specifically for smallmouth bass, channel catfish, and white bass, and an increase in the likelihood of shore anglers being interviewed by survey clerks may be responsible for the majority of the increase in hourly catch rates. As previously mentioned, the bus route survey design is more effective at capturing shore angler information than the access site/aerial survey design. Both white bass and channel catfish are species frequently targeted and caught by shore anglers. Therefore, increasing the percentage of total interviews from shore anglers would lead to an increase in catch rates for species commonly caught or targeted from shore.

Hourly catch rates for walleye were highest during June and July in 2008, while harvest rates were highest during August (Table 31). The release rate for walleye was the highest during June when the 381-mm minimum length limit was in effect. The removal of the minimum length limit for July and August normally results in an increase in the harvest rate those months, when compared to other months in the April-September survey period.

Table 30. Estimated hourly catch rates for walleye, smallmouth bass, white bass, channel catfish, and all fish combined, by year, for all anglers, for the April-September daylight survey period on Lake Sharpe, South Dakota, 1993-2008.

Year	Catch rate (fish/angler-h)				
	Walleye	Smallmouth bass	White bass	Channel catfish	All fish
1993	0.72	0.01	0.04	0.01	0.84
1994	0.72	0.02	0.03	0.01	0.84
1995	0.67	0.03	0.02	0.02	0.83
1996	1.05	0.05	0.02	0.01	1.18
1997	0.83	0.05	0.06	0.02	1.00
1998	0.93	0.08	0.09	0.01	1.18
1999	0.90	0.13	0.06	0.03	1.20
2000	1.04	0.17	0.09	0.03	1.41
2001	1.11	0.13	0.06	0.05	1.40
2002	0.98	0.13	0.22	0.05	1.45
2003	1.33	0.20	0.23	0.05	1.89
2004	0.52	0.19	0.27	0.08	1.13
2005	0.36	0.10	0.31	0.06	0.88
2006	0.57	0.31	0.08	0.05	1.14
2007	1.02	0.60	0.09	0.04	1.85
2008	0.95	0.42	0.06	0.04	1.53

Table 31. Estimated hourly catch, harvest, and release rates, (fish/angler-h), for walleye and all species combined, by month, for the April-September 2008 daylight survey period, on Lake Sharpe, South Dakota.

Month	Walleye			All fish combined		
	Catch rate	Harvest rate	Release rate	Catch rate	Harvest rate	Release rate
April	0.54	0.24	0.30	0.82	0.29	0.53
May	0.86	0.26	0.60	1.77	0.42	1.35
June	1.29	0.10	1.19	1.92	0.22	1.70
July	1.00	0.49	0.51	1.46	0.58	0.88
August	0.75	0.42	0.33	1.09	0.49	0.60
September	0.97	0.29	0.68	1.45	0.35	1.10
Total	0.95	0.29	0.66	1.53	0.40	1.13

The percentage of angling parties catching and harvesting a specified number of walleye in 2008 was similar to 2007 (Table 32). During 2008, a higher percentage of parties caught and harvested walleye while fishing the lower zone of the reservoir than in other zones. In 2008, only 13% of parties caught no walleye in the lower zone compared to 70% and 52% for the middle and

upper zones, respectively. Harvest also mirrored catch, with 33% of parties in the lower zone harvesting no walleye in 2008, compared to 84% and 67% for the middle and upper zones, respectively. During 2008, 16% of the angling parties harvested a limit (four fish) in the lower zone, compared to 2% and 6% in the middle and upper zones, respectively. For the entire reservoir and survey period, 10% of parties fishing Lake Sharpe harvested a limit of walleye (Table 32).

Table 32. Percentage of angling parties catching and harvesting the specified number of walleye and sauger (combined) per person on an angling trip by reservoir zone, for Lake Sharpe, South Dakota, during the April-September 2007 and 2008 daylight survey periods.

Number /trip	Catch per trip							
	2007				2008			
	Lower	Middle	Upper	Total	Lower	Middle	Upper	Total
0	16	58	52	38	13	70	52	38
0.0-0.9	8	14	12	11	7	11	10	9
1.0-1.9	11	14	10	12	11	2	9	9
2.0-2.9	8	3	7	7	6	5	9	7
3.0-3.9	9	3	3	5	7	2	4	5
4.0-4.9	8	0	3	5	11	2	2	6
5.0-5.9	6	0	3	4	6	0	3	4
6.0-6.9	5	1	2	3	5	2	2	3
7.0-7.9	5	1	1	2	5	0	2	3
8.0-8.9	5	0	1	2	6	0	2	3
9.0-9.9	3	2	1	2	3	0	1	2
≥10	16	4	5	9	22	2	3	11

Number /trip	Harvest per trip							
	2007				2008			
	Lower	Middle	Upper	Total	Lower	Middle	Upper	Total
0	37	80	70	57	33	84	67	55
0.0-0.9	12	10	7	10	14	6	8	10
1.0-1.9	14	8	10	11	16	5	11	12
2.0-2.9	11	1	4	7	12	1	4	7
3.0-3.9	8	1	3	5	9	2	4	6
4	18	0	6	10	16	2	6	10

Smallmouth bass catch and harvest per trip for angling parties fishing the lower zone of Lake Sharpe, from 2004 through 2008, are presented in Table 33 and serve as a valuable tool for evaluating effects of the 355-457-mm protected slot length limit implemented in 2008. During the 2003 to 2005 period, the percentage of angling parties that caught no smallmouth bass ranged from 39% to 52%, and for 2006 to 2008, the range dropped to 23% and 28% of parties that

caught no smallmouth bass. For the 2004-2007 period, between 9% and 16% of angling parties in the lower zone harvested smallmouth bass, while in 2002, the last year before regulations were changed, 25% of parties harvested smallmouth bass (Lott et al, 2003). The regulation modification in 2008 allowed for more smallmouth bass harvest, which was reflected in the percentage of angling parties harvesting smallmouth bass increasing over 10% from the previous year, similar to what was observed in 2002, prior to smallmouth bass regulations on Lake Sharpe.

Table 33. Percentage of angling parties catching and harvesting the specified number of smallmouth bass on an angling trip, per person, for the lower zone of Lake Sharpe, during the April-September daylight survey period, 2004-2008.

Number /trip	Catch per trip					Harvest per trip				
	2004	2005	2006	2007	2008	2004	2005	2006	2007	2008
0	39	52	28	23	24	86	91	84	87	77
0.1-0.9	14	15	28	11	19	8	5	12	7	11
1.0-1.9	15	13	14	14	14	4	2	3	4	7
2.0-2.9	10	6	5	8	8	2	1	0	1	3
3.0-3.9	5	4	5	7	7	0	1	1	1	1
4.0-4.9	4	3	4	3	4	0	0	0	0	1
5.0-5.9	3	1	2	6	4	0	0	0	0	0.1
6.0-6.9	3	2	4	4	3					
7.0-7.9	1	1	3	3	4					
8.0-8.9	1	1	1	2	1	**Daily limit of 5**				
9.0-9.9	0	0	1	1	1					
≥10	4	2	5	18	11					

Angler Demographics and Economic Impacts

For the April-September 2008 daylight period, Lake Sharpe anglers contributed approximately 7.5 million dollars to local economies, based on an estimated 95,113 trips (Table 20) at an estimated $79 per trip for South Dakota's Missouri River reservoirs (U.S. Dept. of Interior, Fish and Wildlife Service, and U.S. Dept. of Commerce, Bureau of the Census 2007).

Average party size was 2.1 anglers/party and average trip length was 3.3 h, during the April-September 2008 period. Residents comprised 85% of angling parties interviewed on Lake Sharpe during the April-September 2008 daytime survey period, a value within the range from previous years (Table 34). The percentage of resident anglers is generally lowest in lower Lake Sharpe and highest in middle Lake Sharpe. Campground facilities at West Bend and Big Bend Dam and a high percentage of boat anglers in lower Lake Sharpe may contribute to the higher percentage of non-residents fishing this zone of the reservoir. The majority of anglers fishing middle Lake Sharpe are generally local residents.

The majority of non-resident anglers fishing Lake Sharpe in 2008 were from the states of Nebraska, Minnesota, and Iowa. Patterns in angler state of residency in 2008 remained similar to other years from 2004-2007 (Table 35). During 2008, residents of 22 states, other than South Dakota, were interviewed while fishing Lake Sharpe.

Table 34. Percentage of total angler contacts for resident and non-resident (states combined) anglers fishing Lake Sharpe during the April-September daylight period, 2004-2008. N is the number of parties interviewed.

Zone		Year				
		2004	2005	2006	2007	2008
Lower	**N**	438	363	413	559	233
	Residents (%)	74	79	73	70	78
	Non-residents (%)	26	21	27	30	22
Middle	**N**	208	162	278	189	176
	Residents (%)	90	91	92	90	90
	Non-residents (%)	10	9	8	10	10
Upper	**N**	692	616	668	545	572
	Residents (%)	88	86	89	90	89
	Non-residents (%)	12	14	11	10	11
Total	**N**	1,338	1,141	1,151	1,293	1,281
	Residents (%)	84	85	85	81	85
	Non-residents (%)	16	15	15	19	15

Table 35. Percentage of total non-resident angler contacts for anglers from the states listed, for Lake Sharpe, South Dakota during the April-September daylight survey period, 2004-2008.

State	Percent by Year				
	2004	2005	2006	2007	2008
Iowa	26	28	22	19	23
Nebraska	24	32	34	27	25
Colorado	6	6	4	7	6
Minnesota	21	13	19	22	19
Wisconsin	1	1	2	1	4
Wyoming	4	2	2	2	6
Other*	18	18	17	22	16

*Other includes Arizona, Georgia, Idaho, Illinois, Indiana, Kansas, Maryland, Michigan, Missouri, Montana, New Mexico, New York, North Dakota, Oklahoma, Texas, and Utah.

County of residence of South Dakota resident anglers fishing Lake Sharpe during the April-September 2008 survey period are presented in Figure 10 and Table 36. Nearly half (45%) of

resident angling parties interviewed on Lake Sharpe during the 2008 survey were local anglers from Hughes and Stanley counties (Figure 10). Minnehaha (Sioux Falls) and Pennington (Rapid City) county residents made up 8% and 5% of the interviewed angling parties, respectively. The percentage of angler interviews from residents of Beadle, Brookings, Davison, Hand, and Lyman remained within ranges seen in past years (Table 36).

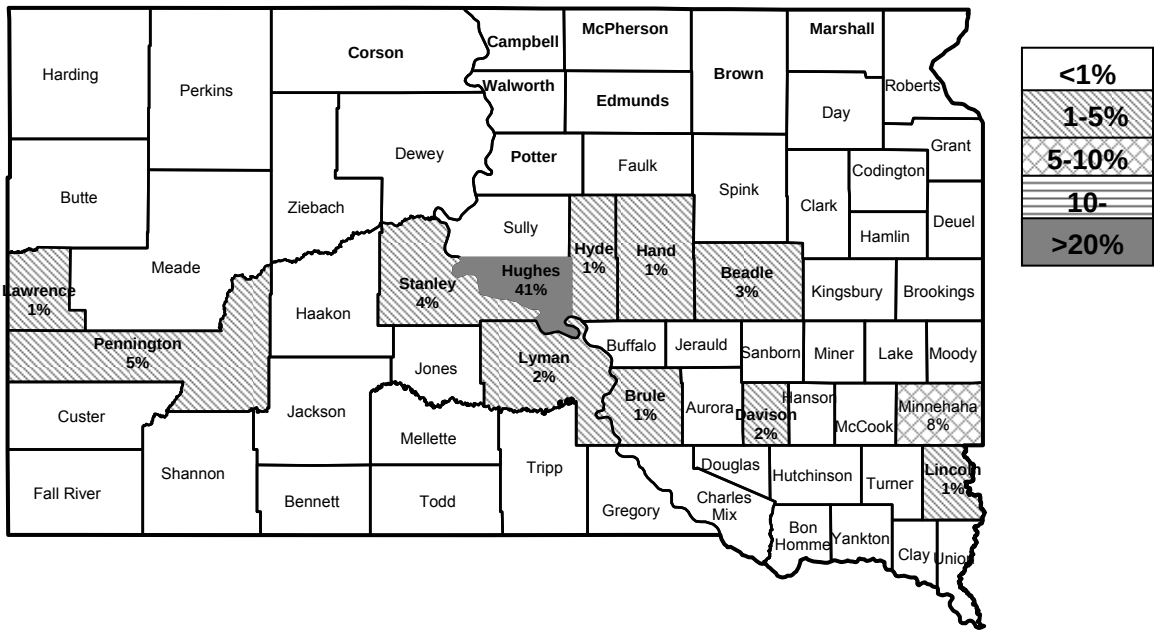

Figure 10. Percentage of total angler contacts on Lake Sharpe, of residents of the counties illustrated, during the April-September 2008 daylight survey period.

Table 36. Percentage of total angler contacts on Lake Sharpe, of residents of the counties listed, for anglers fishing Lake Sharpe, South Dakota during the April-September daylight survey period, 2004-2008.

County	Major City	Percent by year				
		2004	2005	2006	2007	2008
Beadle	**Huron**	3	4	4	6	3
Brookings	**Brookings**	1	1	1	1	1
Davison	**Mitchell**	2	2	1	2	2
Hand	**Miller**	1	1	2	2	1
Hughes	**Pierre**	43	51	52	45	41
Lyman	**Presho, Kennebec**	1	1	2	3	2
Minnehaha	**Sioux Falls**	7	8	5	7	8
Pennington	**Rapid City**	5	5	6	7	5
Stanley	**Fort Pierre**	6	6	7	7	4

Residents of Hughes and Stanley Counties comprised the majority of anglers traveling <25 miles and 25-49 miles, one way, to fish Lake Sharpe in 2008, while anglers from Minnehaha and Pennington counties comprised the majority of anglers traveling 100-199 miles to fish Lake Sharpe (Table 37). With Lake Sharpe located some distance from a large population base; travel is required for many anglers fishing Lake Sharpe. The percentage of interviewed anglers

traveling in excess of 200 miles, one way, to fish Lake Sharpe in 2008 was similar to the 2005. Higher travel costs in 2008 did not appear to inhibit anglers traveling to Lake Sharpe.

Table 37. Percentage of anglers driving the specified distances, one way, to fish Lake Sharpe, South Dakota, during the April-September daylight survey period, 2004-2008.

Distance (miles)	Percent by year				
	2004	2005	2006	2007	2008
<25	44	46	47	38	38
25-49	8	6	6	12	6
50-99	8	6	8	11	13
100-199	19	17	15	18	18
≥200	21	25	24	21	26

As previously mentioned, the increase in hourly catch rates for smallmouth bass may be due, in part, to an increase in the percentage of total angler interviews that are shore anglers. Species targeted by anglers in 2008 was similar to previous years (Table 38). Percentage of anglers targeting smallmouth bass remained higher than the three year average.

Table 38. Target species of anglers fishing Lake Sharpe, South Dakota, during the April-September daylight survey period, expressed as percent of total, 2004 - 2008.

Target species	Percent by year				
	2004	2005	2006	2007	2008
Walleye	59	57	58	57	60
Anything	33	33	33	32	32
Rainbow trout	4	3	2	1	0.4
White bass	1	4	1	2	1
Smallmouth bass	2	1	2	6	4
Other*	1	2	4	2	2

*Other includes black crappie, channel catfish, northern pike, and white crappie.

Satisfaction and Attitudes

How anglers feel about their fishing experience is important to the success of a fishery. Angler responses help fisheries managers determine if current management practices and regulations are providing a fishery that meets angler needs and expectations.

When anglers were asked to consider all factors when stating their level of satisfaction with their fishing trip, the median trip rating for the April-September 2008 period was “moderately satisfied” (median of 2, Table 39). The median satisfaction rating of “moderately satisfied” for 2008 was the

same as 2006 and 2007 (Potter and Lott. 2007). Approximately 83% of angling parties interviewed in 2008 indicated some degree of satisfaction, a value above the Lake Sharpe Strategic Plan objective of 70%. Neutral and dissatisfied anglers comprised 6% and 10% of angler interviews, respectively. Median trip satisfaction increased from "moderately satisfied" to "very satisfied", as the average number of walleye harvested per angler increased (Table 40). Gigliotti (2004) documented other factors besides the number of walleye harvested must influence trip satisfaction because 76% of anglers keeping zero walleye during their trip expressed some degree of satisfaction with their trip (Table 40).

Table 39. Responses of Lake Sharpe anglers who were asked the following question during the April-September 2008 daylight survey period: "Considering all factors, how satisfied are you with your fishing trip today?" 1 = very satisfied, 2 = moderately satisfied, 3 = slightly satisfied, 4 = neutral, 5 = slightly dissatisfied, 6 = moderately dissatisfied, 7 = very dissatisfied, and 8 = no opinion (N.O.). N is sample size and does not include "no opinion" responses.

Month	Satisfaction rating								N	Median
	Satisfied			Neutral	Dissatisfied			N.O.		
	1	2	3	4	5	6	7	8		
April	59	87	16	7	10	3	3	4	185	2
May	90	91	38	16	12	5	2	2	254	2
June	78	85	25	26	8	6	6	4	234	2
July	80	63	15	12	11	9	8	0	198	1
August	29	35	25	9	11	3	2	0	114	2
September	80	120	43	10	8	11	10	4	282	2
Total	416	481	162	80	60	37	31	14	1,267	
Percent	84			6	10					

Table 40. Responses of Lake Sharpe anglers who were asked the following question during the April-September 2008 daylight survey period: "Considering all factors, how satisfied are you with your fishing trip today?" compared to the average number of walleye harvested per trip. 1 = very satisfied, 2 = moderately satisfied, 3 = slightly satisfied, 4 = neutral, 5 = slightly dissatisfied, 6 = moderately dissatisfied, 7 = very dissatisfied, and 8 = no opinion (N.O.). N is sample size and does not include "no opinion" responses.

Walleye/ angler	Satisfaction rating								N	Median
	Satisfied			Neutral	Dissatisfied			N.O.		
	1	2	3	4	5	6	7	8		
0	160	260	110	64	45	29	25	14	693	2
0-0.9	36	54	22	5	5	5	3	0	130	2
1.0-1.9	59	64	14	9	6	1	3	0	157	2
2.0-2.9	41	36	9	0	4	1	0	0	91	1
3.0-3.9	41	26	3	1	0	0	0	0	71	1
4	75	41	4	1	0	1	0	0	122	1
Percent	83			6	10					

Beginning in 2003, a 305-457-mm protected slot with a one over 457-mm regulation was placed in effect for smallmouth bass on Lake Sharpe. In 2008, the regulation was altered to a 355-457-mm protected slot with a one over 457-mm. Anglers were asked if they were in favor of the current regulation for smallmouth bass. For the lake-wide results, the largest percentage (49% for total sample) indicated they were in favor of the regulation, but a significant portion expressed no opinion (30% for total sample;Table 41). When the "no opinion" answers are removed from the sample, 71% were in favor of the current smallmouth bass regulation. By reservoir zone, the lower zone had the lowest percentage of approval at 65% (Table 41).

Fishing tournaments take place on Missouri River reservoirs annually. Conflicts can arise due to access crowding when tournaments take place on days with significant angling use. To better understand angler attitudes towards tournaments, anglers were asked how they felt about fishing tournaments on the Missouri River (Table 41). Of the anglers interviewed, 39% responded positively to tournaments, while only 18% responded negatively with 25% neutral. Less than one percent of respondents had no opinion on fishing tournaments on the Missouri River.

Anglers that indicated they had released at least one smallmouth bass during their angling day were also asked "Of the smallmouth bass you caught today, how many more bass would your party have harvested had there been no length restrictions?" (Table 41). The majority (64%) indicated they would have harvested no more smallmouth bass had there been no length restrictions.

Table 41. Responses and percentages of anglers interviewed during the April-September 2008 daytime survey on Lake Sharpe that responded to additional questions. Question C was only asked if anglers released at least 1 smallmouth bass during their trip.

Question A. "Are you in favor of the current smallmouth bass regulation of a 14- to 18-inch protected slot, which requires all smallmouth bass between 14 and 18 inches to be released?

	Zone	Yes	N	No	N	No opinion	N
With	Upper	51	146	17	50	32	92
No	Middle	50	44	17	15	33	29
Opinion	Lower	48	128	25	68	27	73
Responses	Total	49	318	21	133	30	194
Without	Upper	74	146	26	50	Removed from sample	
No	Middle	75	44	25	15		
Opinion	Lower	65	128	35	68		
Responses	Total	71	318	29	133		

Question B. How do you feel about fishing tournaments held on the Missouri River system?

Response	Percent	Number
Very favorable	17	106
Favorable	22	137
Neutral	25	158
Opposed	8	51
Very opposed	10	61
No opinion	0.3	2

Question C. Of the smallmouth bass you caught today, how many more bass would your party have harvested had there been no length restrictions?

Number of additional smallmouth bass	%	N
0	64	289
1-5	26	119
6-10	8	37
>10	2	9

Anglers harvested an estimated 14,803 smallmouth bass from Lake Sharpe during the April-September daylight period during 2008 (Table 26). If the regulation had not been in effect in 2008, there was a potential harvest of 36,107 smallmouth bass during April-September that could have occurred (Table 42). Prior to the regulation change in 2003, smallmouth bass harvest was estimated at 11,696 for 2002, 14,673 for 2001, 13,765 for 2000, and 12,005 for 1999 (Johnson and Lott 2000, 2001; Johnson, et al. 2002; Lott et al. 2003). If harvest would have been 36,107 for 2008, had the regulation not been in place, it would have been substantially higher than what was estimated for previous years.

Table 42. Potential angler harvest of smallmouth bass based on anglers responses to the following question, "Of the smallmouth bass you caught today, how many more smallmouth bass would your party have harvested had there been no length restrictions on harvesting smallmouth bass?" Estimated values are numbers generated by extrapolating interview data over estimated fishing pressure, while observed values are generated directly from interviews.

	Harvest	Catch	Percent harvested
Actual			
Observed	481	4,336	11%
Estimated	14,803	132,454	
Potential			
Observed	1,182	4,336	27%
Estimated	36,107	132,454	

FISHERY STATUS AND 2009 OUTLOOK

The main objective of the Lake Sharpe Fisheries Strategic Plan is "To provide a fishery that can annually support a minimum of 100,000 angler days of recreation with a harvest rate of 0.35 fish/angler-h, and a 70% angler trip satisfaction rating." All parts of this objective were met for 2008 with the exception of angler days. In 2008, the estimated harvest rate was 0.40 fish/angler-h for all species combined, with an overall satisfaction rating of 83% and 95,113 angler days of estimated fishing pressure. Walleye-specific objectives of 100,000 walleye harvested with a harvest rate of 0.3 walleye/angler hour were not met in 2008, with an estimated 92,545 walleyes harvested and a harvest rate of 0.29 walleye/angler-h. Walleye harvest and harvest rates below strategic plan objectives in 2008 are likely due to the large 2005 and 2006 year classes that dominated angler catch in 2008.

High recruitment of the 2005 through 2007 walleye year classes into the population and high reproduction in 2008 for walleye will help provide a walleye fishery for the future, especially with low recruitment of the 2001-2004 year classes. Growth of walleye should be monitored closely during upcoming years as four consecutive years of above average walleye reproduction could lead to slowed growth. As expected, age-3 walleye comprised the largest portion of the gill net catch in 2008 as age-2 walleye made up the largest portion of the catch in 2007. Walleye growth rates have remained adequate due to sufficient prey availability, as shown by seining data from 2008. With quality year classes from 2005 through 2008, walleye fishing should be good in 2009 with more fish growing past the 15 inch minimum size limit.

Smallmouth bass nighttime electrofishing CPUE remained the same at 21 fish/h in 2007 and 2008 at Joe Creek, while values for Big Bend Dam have been similar during all years sampled with the exception of the 2006 sample. Stock density indices increased from 2007 to 2008 for smallmouth bass at both Joe Creek and Big Bend Dam. Proportional stock density of smallmouth bass at Joe Creek and Big Bend Dam and relative stock density of memorable length fish at Big Bend Dam were at the highest levels recorded during the previous five year period. Growth and condition of smallmouth bass remains good, with growth above the statewide and Missouri River reservoir averages.

Creel survey data from concluded that the current smallmouth bass regulation had a 77 percent reduction of harvest of smallmouth bass, from previous years, and was too restrictive to allow adequate harvest of the smaller bass. Of the anglers interviewed, 54 percent were in favor of the current regulation and over 60 percent of the anglers against the current regulation would be in favor of a 14-18 inch slot length limit. Therefore, in 2007, GFP modified the protected slot from a 305-457 mm (12-18-inch) to a 357-457mm (14-18-inch) protected slot length limit. This new regulation went into effect January 2008, and allowed anglers to harvest bass up to 14-inches while still protecting the larger individuals in the population. With nearly 15,000 smallmouth bass harvested in 2008, the regulation allowed for nearly double the harvest of smallmouth bass that occurred the previous year. However, harvest of smallmouth bass from Lake Sharpe in 2008 was similar to harvest levels just prior to regulation implementation in 2003. Further increase of harvest is still needed to modify size structure of the smallmouth bass population in Lake Sharpe.

MANAGEMENT RECOMMENDATIONS

- Continue to conduct annual angler use and harvest surveys for the April-September daylight period.

- Continue to conduct annual fish population surveys including spring electrofishing, shoreline seining, August gillnetting, and fall electrofishing.

- Monitor effects of four consecutive year classes of above average walleye reproduction.

- Continue to investigate smallmouth bass regulations on Lake Sharpe and determine angler acceptance of these regulations.

- Evaluate management objectives for secondary species, other than walleye, including white bass, channel catfish, rainbow trout, and smallmouth bass, to more accurately reflect the potential of these species, in terms of providing increased angler days on Lake Sharpe.

- Update Lake Sharpe Fisheries Management Plan by June 2009.

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APPENDICES

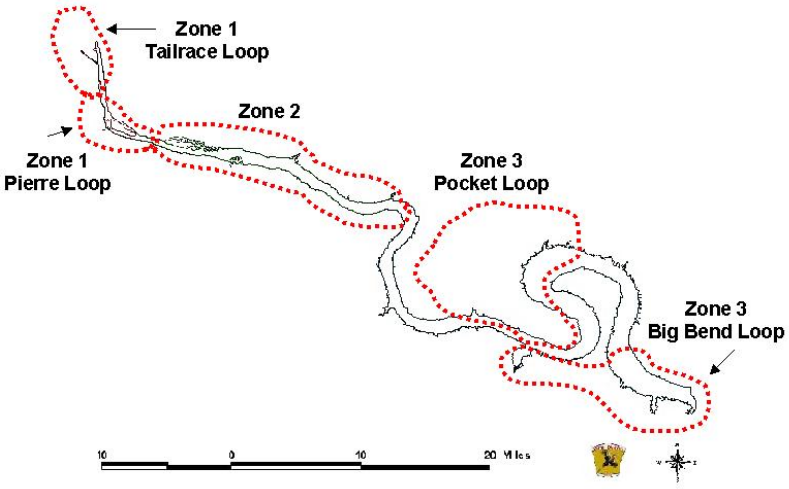
Appendix 1. Common and scientific names of fishes mentioned in this report.

Common Name	Abbreviations	Scientific Name
Bigmouth buffalo	BIB	*Ictiobus cyprinellus*
Black bullhead	BLB	*Ameiurus melas*
Black crappie	BLC	*Pomoxis nigromaculatus*
Blue catfish	BCF	*Ictalurus furcatus*
Bluegill	BLG	*Lepomis macrochirus*
Bluntnose minnow	BLM	*Pimephales notatus*
Brassy minnow	BRM	*Hybognathus hankinsoni*
Channel catfish	CCF	*Ictalurus punctatus*
Common carp	COC	*Cyprinus carpio*
Emerald shiner	EMS	*Notropis atherinoides*
Freshwater drum	FRD	*Aplodinotus grunniens*
Gizzard shad	GZD	*Dorosoma cepedianum*
Goldeye	GOE	*Hiodon alosoides*
Johnny darter	JOD	*Etheostoma nigrum*
Largemouth bass	LMB	*Micropterus salmoides*
Northern pike	NOP	*Esox Lucius*
Rainbow smelt	RBS	*Osmerus mordax*
Rainbow trout	RBT	*Oncorhynchus mykiss*
River carpsucker	RIC	*Carpiodes carpio*
Sauger	SAR	*Sander canadensis*
Shorthead redhorse	SHR	*Moxostoma macrolepidotum*
Shortnose gar	SHG	*Lepisosteus platostomus*
Shovelnose sturgeon	SHS	*Scaphirhynchus platorynchus*
Smallmouth bass	SMB	*Micropterus dolomieu*
Smallmouth buffalo	SAB	*Ictiobus bubalus*
Spottail shiner	SPS	*Notropis hudsonius*
Walleye	WAE	*Sander vitreus*
White bass	WHB	*Morone chrysops*
White crappie	WHC	*Pomoxis annularis*
White sucker	WHS	*Catostomus commersoni*
Yellow perch	YEP	*Perca flavescens*

Appendix 2. Minimum lengths (mm) for length class designations for smallmouth bass, walleye, sauger, channel catfish, white bass and yellow perch (Gablehouse 1984).

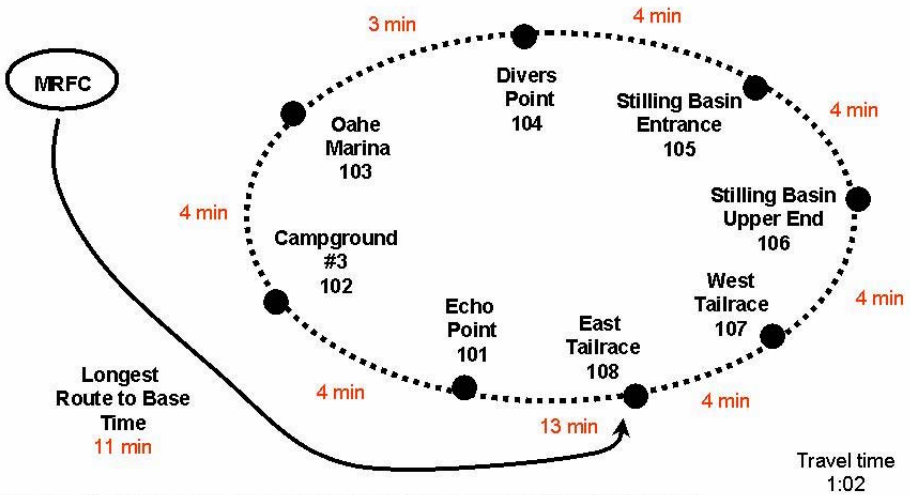
Species	Stock	Quality	Preferred	Memorable	Trophy
Smallmouth bass	180	280	350	430	510
Walleye	250	380	510	630	760
Sauger	200	300	380	510	630
Channel catfish	280	410	610	710	910
White bass	150	230	300	380	460
Yellow perch	130	200	250	300	380

Lake Sharpe Bus Route Loops



Appendix 3. Lake Sharpe bus route loop map depicting locations of the 5 overall loops for angler use and harvest surveys during April – September, 2008.

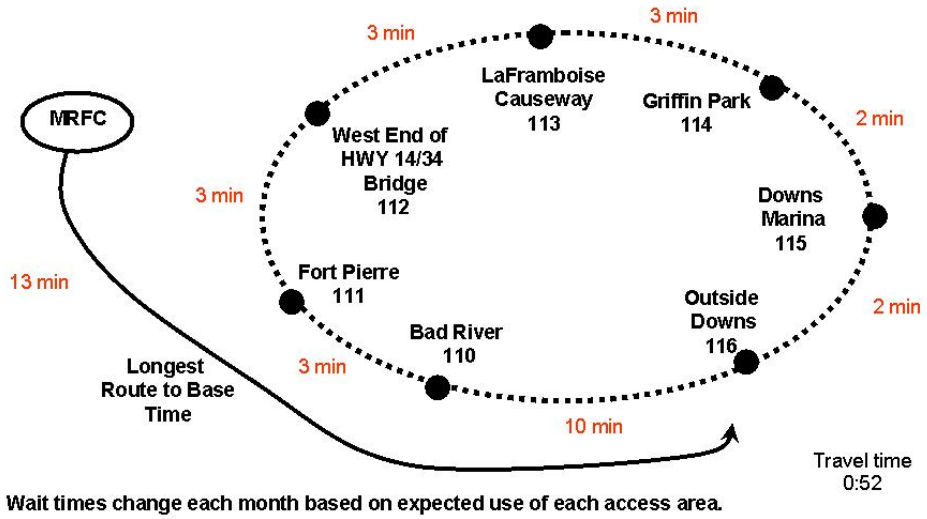
Zone 1 - Tailrace Loop - Car Travel Times Listed



Wait times change each month based on expected use of each access area.

Appendix 4. Overall design of the tailrace loop for angler use and harvest surveys for Lake Sharpe, SD during April-September, 2008.

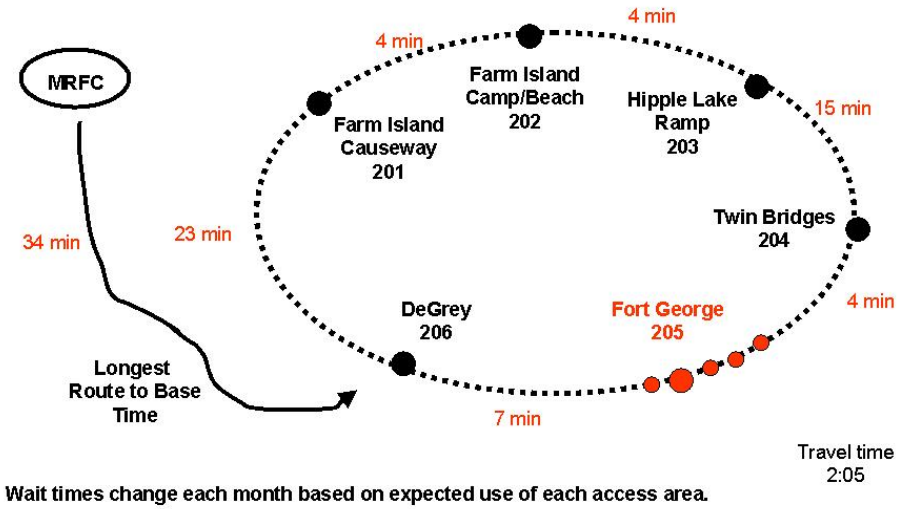
Zone 1 - Pierre Loop - Car Travel Times Listed



Wait times change each month based on expected use of each access area.

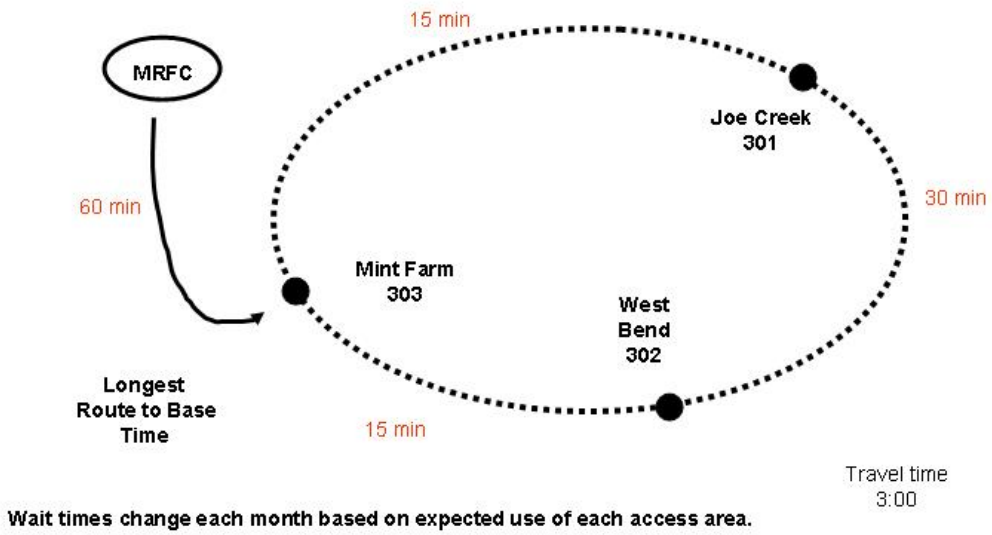
Appendix 5. Overall design for the Pierre Loop for the angler use and harvest survey for Lake Sharpe, SD during April-September, 2008.

Zone 2 - 4WD Only Travel Times Listed

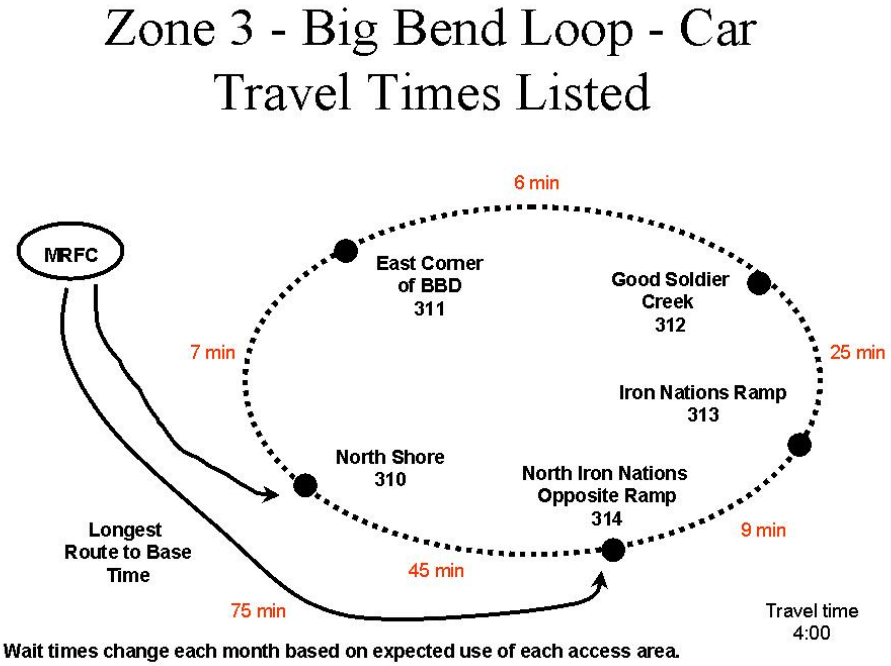


Wait times change each month based on expected use of each access area.

Appendix 6. Overall design for Zone 2 loop for the angler use and harvest survey for Lake Sharpe, SD during April-September, 2008.



Appendix 7. Overall design for the Pocket Loop for the angler use and harvest survey for Lake Sharpe, SD during April-September 2008.



Appendix 8. Overall design for the Big Bend Loop for the angler use and harvest survey for Lake Sharpe, SD during April-September, 2008.

Appendix 9. Angler satisfaction, preference, and attitude questions asked as part of the April-September 2008 angler use and harvest survey on Lake Sharpe, South Dakota.

Trip Satisfaction Question:

Considering all factors, how satisfied are you with your fishing trip today?

(Read the following response categories)
1 = VERY
2 = MODERATELY **SATISFIED**
3 = SLIGHTLY
4 = NEUTRAL *(neither satisfied or dissatisfied)*
5 = SLIGHTLY
6 = MODERATELY **DISSATISFIED**
7 = VERY
8 = NO OPINION

Additional Questions:

1. Are you in favor of the current smallmouth bass regulation of a 14-to-18-inch protected slot, which requires all smallmouth bass between 14 and 18 inches to be released?

   YES NO NO OPINION

2. How do you feel about fishing tournaments held on the Missouri River?

(Read the following response categories)
1 = VERY FAVORABLE
2 = FAVORABLE **SATISFIED**
3 = NEUTRAL *(neither satisfied or dissatisfied)*
5 = OPPOSED **DISSATISFIED**
6 = VERY OPPOSED
7 = NO OPINION

3. *(Clerk asks if smallmouth bass were released)*
   Of the smallmouth bass you caught today, how many more smallmouth bass would your party have harvested had there been no length restrictions?

   (Remember, maximum harvest per angler is 5 smallmouth bass daily)

Appendix 10. White bass and yellow perch proportional stock density (PSD) relative stock density of preferred-length fish, and mean relative weight values, for 1997-2008, for fish collected in the standard August gill net survey, on Lake Sharpe South Dakota.

White bass					
Year	**PSD**	**RSD-P**	**RSD-M**	***Wr***	**N**
1997	96	58	13	94	24
1998	94	94	22	101	18
1999	100	72	24	102	54
2000	98	83	13	99	55
2001	100	91	26	100	46
2002	68	15	8	100	71
2003	96	39	13	91	70
2004	92	74	6	94	62
2005	100	60	0	101	11
2006	96	15	4	103	52
2007	98	96	20	95	45
2008	100	100	41	95	37
Yellow perch					
Year	**PSD**	**RSD-P**	**RSD-M**	***Wr***	**N**
1997	43	4	0	89	23
1998	28	6	0	91	18
1999	59	27	0	82	22
2000	22	6	0	85	36
2001	55	0	0	86	20
2002	42	8	0	77	24
2003	25	8	0	85	23
2004	43	5	0	88	21
2005	23	0	0	86	45
2006	53	0	0	112	40
2007	37	5	0	83	31
2008	47	0	0	87	23